JTRS Cluster 1 Simulation Support Plan v2.0

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Outline

- SSP Task Review
- Program Overview
- SSP v 2.0
  - Opportunities and Tools
    - Combat Development
    - Systems Engineering
    - DT / OT
    - Supportability
    - Cost Analysis
    - Operational Uses
    - Advanced Collaborative Environment
  - Primary Thrusts
    - DES
    - HiL/SiL
    - Supporting

Task Review

Scope: Develop a comprehensive Modeling and Simulation Plan for the JTRS Cluster 1 Acquisition

"Prepare the JTRS Cluster 1 Modeling and Simulation Plan…consisting of the following three components:

1. **Identification of Opportunities**: The TIC shall evaluate all current JTRS Cluster 1 related documentation, including the Operational Requirements Document (ORD), Acquisition Plan (AP), Acquisition Strategy Report (ASR), Test and Evaluation Master Plan (TEMP), Statement of Work (SOW), Performance Requirements Document (PRD), Wideband Network Waveform Functional Description Document (FDD) and other legacy waveform specifications in order to identify opportunities for the application of models and simulations for the JTRS Cluster 1 acquisition. The focus of this review shall be to identify key program phases, events and milestones at which models and simulators can be applied in order to reduce time, resources, and risk for JTRS Cluster 1, increase the quality, military worth and supportability of the fielded JTRS systems, and reduce total ownership costs throughout the system lifecycle.

Task Review (Cont.)

2. **Survey of Existing Models**: The TIC shall conduct a comprehensive survey of existing models and simulators potentially applicable to the JTRS Cluster 1 acquisition, including those models procured under the JTRS Step 2A and Step 2B programs. Existing models can be broadly categorized into force, network, and traffic based models. Force based models exist which define both current and planned communications hardware, and doctrinal deployment requirements. Network based models identify switches, routers, and relay capabilities, as well as net membership and host computer systems. Traffic based models identify mission essential information exchanges requirements between platforms within the force to support functions each platform performs and may include specified scenario information. The survey shall also address the use of terrain elevation and vegetation products within the models, propagation loss and antenna models, waveforms implemented, protocols supported, analysis tools, operational and networking metrics, etc. The survey shall address both military (e.g., Army Signal Center M&S Branch) and commercial (e.g., OPNET) sources, and include a detailed description of the models and/or simulator, including processing/hardware requirements, as well as documentation availability, licensing issues, and anticipated lifecycle costs. Finally, a detailed description of the verification, validation, and accreditation status (in accordance with DoDI 5000.61) for each of the models shall be provided.

3. **Proposal for Modification to Existing Models/New Model Development**: Following identification of the opportunities for the application of models and simulators and the survey of existing models, the TIC shall make detailed recommendations for the use of M&S during the Cluster 1 acquisition. This proposal may consist of both specific recommended modifications to existing models as well as new model development. In addition, the TIC shall identify detailed recommended modifications/additions to the program documentation identified above in support of the JTRS Cluster 1 Milestone B. A schedule for the proposed modifications/developments shall be provided as well as funding requirements and supporting cost and budgetary information."

Schedule

30 Dec 01: SSP Version 1.0 delivered
Contains the results of the "Identification of Opportunities" phase. Based on a comprehensive review of the applicable acquisition documents we will identify opportunities for use of modeling and simulation to reduce time, resources and risk to the JTRS cluster 1 acquisition. The opportunities will be specific whereas the modeling and simulation capability to apply to the opportunity will be generic.

30 Mar 02: SSP Version 2.0 delivered
We will begin to identify the leading modeling and simulation capabilities to apply to the specific opportunities identified in the version 1.0 draft. We will identify specific modeling and simulation capabilities and programs. We will apply screening criteria to limit the number of candidates per opportunity to a reasonable number (2-4).

30 June 02: SSP Version 3.0 delivered
Based on a thorough evaluation of each of the capabilities identified in the version 2.0 draft we will recommend a specific course of action. We will look for mutually supporting programs/systems and model reuse.

1 Sep 02: Draft Final SSP delivered
Based on feedback from the version 3.0 draft we will continue to refine the approach and reflect the changes in this final draft. We will re-package the report to serve as an SSP.

30 Sep 02: SSP Final

JTRS Cluster 1 Program Review

Why JTRS?

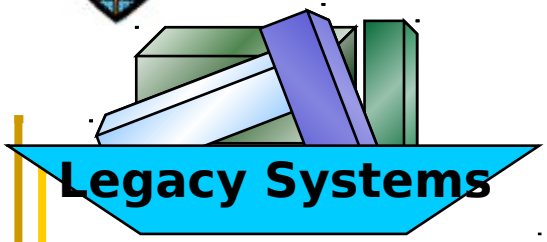
TALKING POINTS FOR ARMY LEADERSHIP

- Each IT advancement spawned a new, unique comm system
- Systems could not interoperate with other systems
- Despite weapons technology, warfighters in *Gulf War* were forced to use *cell phones* to coordinate with different services
- Systems are unique not only to services, but even within warfare domains (Sea, Air, Land, Special Forces)
- The paradigm of modern maneuver warfare in a Joint/Coalition environment cannot be achieved with unique legacy systems

CRITICS

- **Affordability**
- **Near Term Availabilit**

JTRS Concept



Characteristics

- Traditionally operate in a **single frequency band & in a single mode**
- Complex network management
- Limited networking capability
- Proprietary standards

UHF

VHF

HF

Frequency bands

Data

Voice

Video

Phased implementation over time

Characteristics

- **Software programmable**
- **Multi-band; multi-mode** (Voice, video & data)
- Backwards compatible with legacy systems
- Modular design
- Scaleable
- Flexible form factor (Family of radios)
- Demand adaptive (Dynamic Bandwidth Management)
- Networked
- Secure
- Open systems architecture

A Common Architecture Provides the Solution

Current Systems (25-30 Families)

- Navigation
- Positioning
- Location
- Identification
- Air to Ground
- Air to Air
- Ground to Ground
- SATCOM

AN/PSQ-6A EPLRS

AN/ARC-210

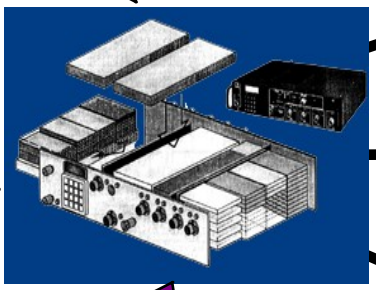
AN/WCS-3 UHF SATCOM/LOS

AN/ARC-201A SINCGARS

ANPRC-119 SINCGARS

AN/PSC-5

Common Open Standards Architecture & Technology Base



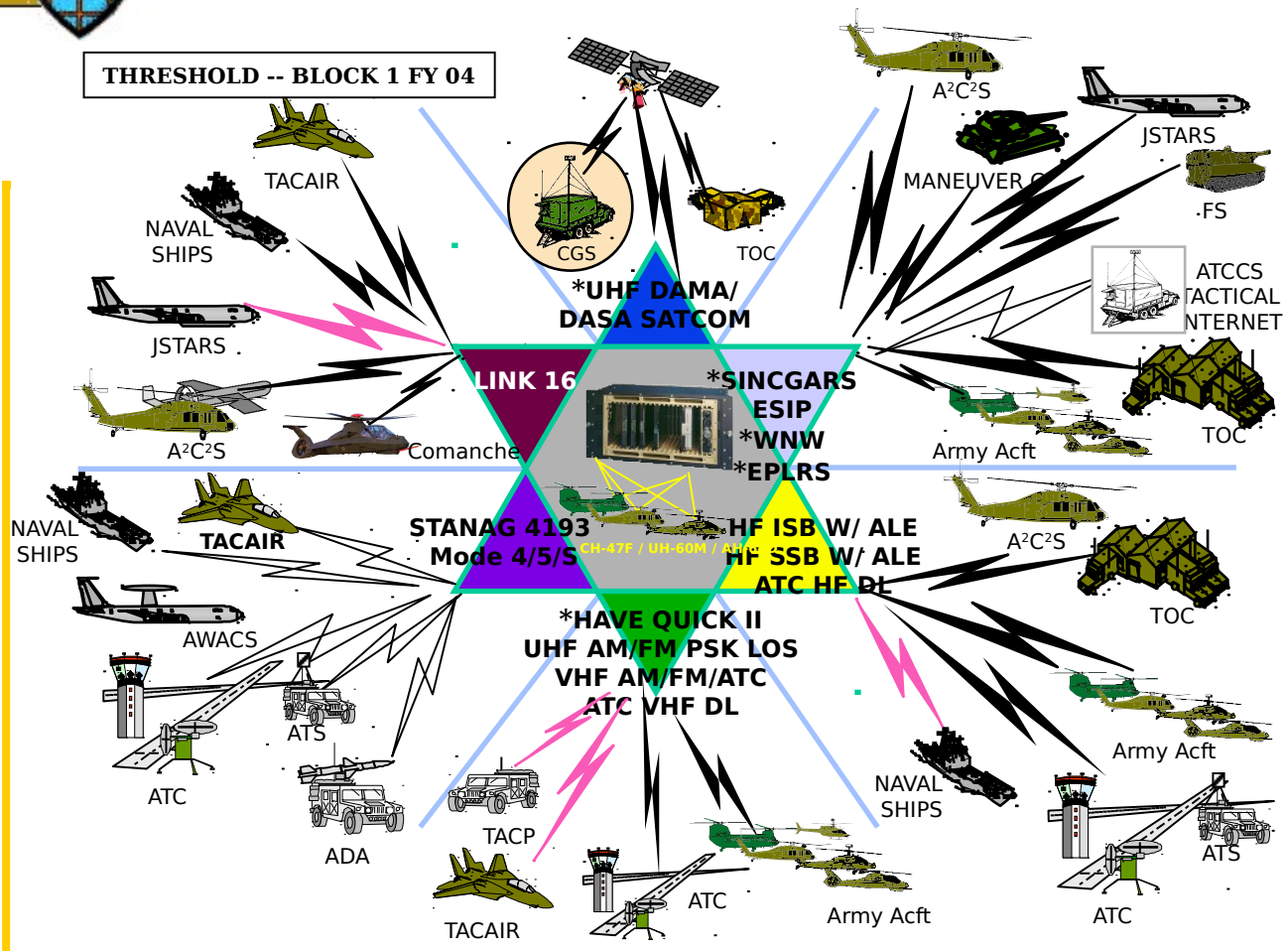
Joint Solutions (1 Family)

Operational Domains

- **Airborne**
- **Ground Forces**
  - Hand held
  - Dismounted
  - Vehicular
- **Maritime/ Fixed Station**

Legacy Waveforms Commercial Waveforms New Military Waveforms

JTRS Cluster 1 Interoperability



- ***Connectivity via Voice and Data Links to:***
- ***Maneuver CDR TOC***
- ***AVTOC***
- ***Army Systems***
  - ***Comanche***
  - ***A2C2S***
  - ***Bradley***
  - ***Crusader***
  - ***Abrams***
  - ***Land Warrior***
  - ***GUARDRAIL/ACS***
- ***Joint/National Systems***
  - ***JSTARS***
  - ***AWACS***
  - ***F-15, F-16, F-22, JSF, F-18, AH-1W***
  - ***AEGIS Cruisers***
- ***Use of Standard Message Formats***
  - ***JVMF (USMTF)***
  - ***TADIL/J***

REAL-TIME DIGITAL COMBAT COMMUNICATION

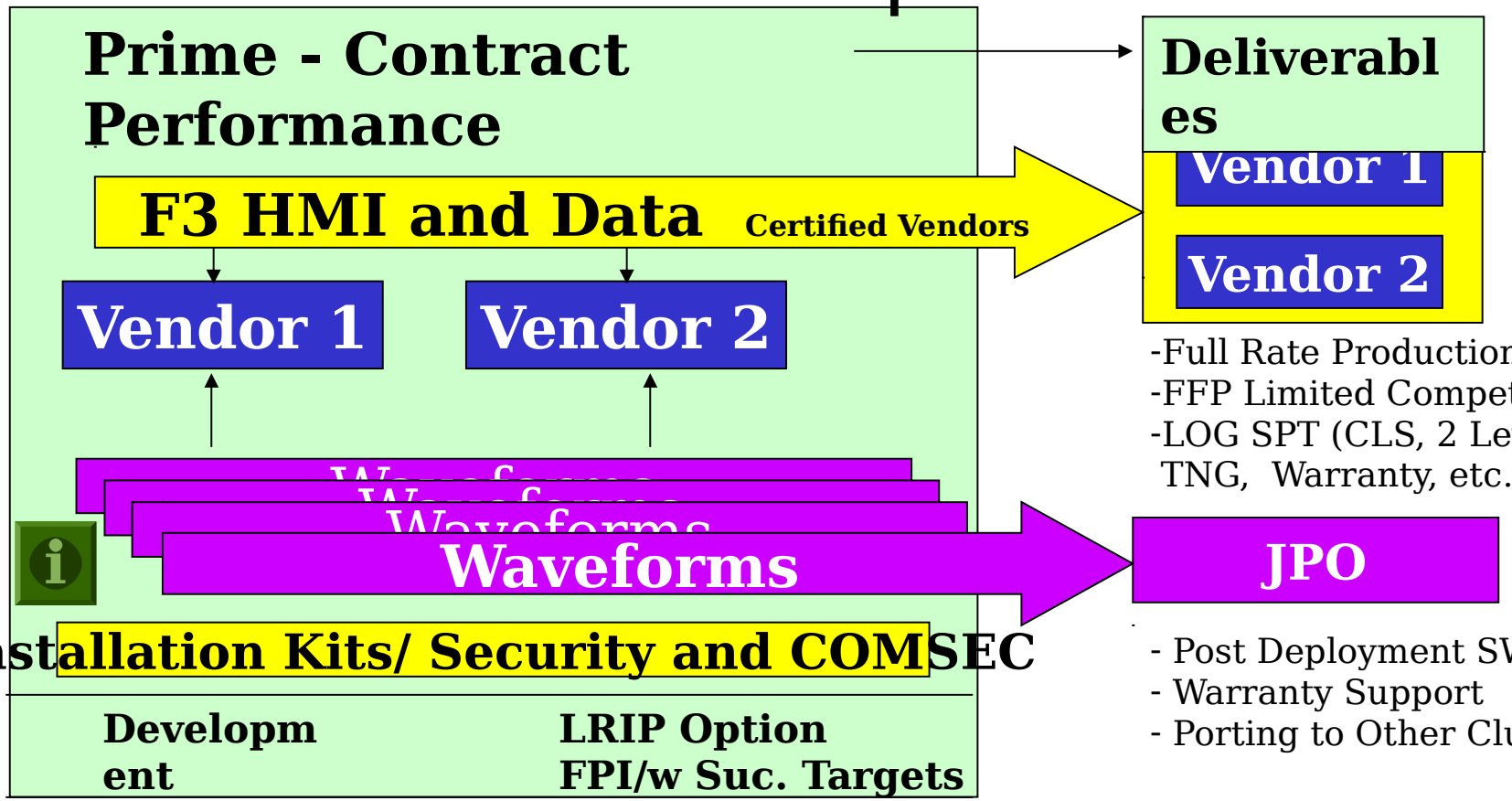
- **Flexible Architecture**
- **Software Configurable**
- **Accommodates Evolving Requirements & Technology Growth**

BLOCK 2 FY 06
LINK 11
LINK 4A
SINCGARS
EBC/IDM)

BLOCK 3 FY 07
IBS-M
SINCGARS

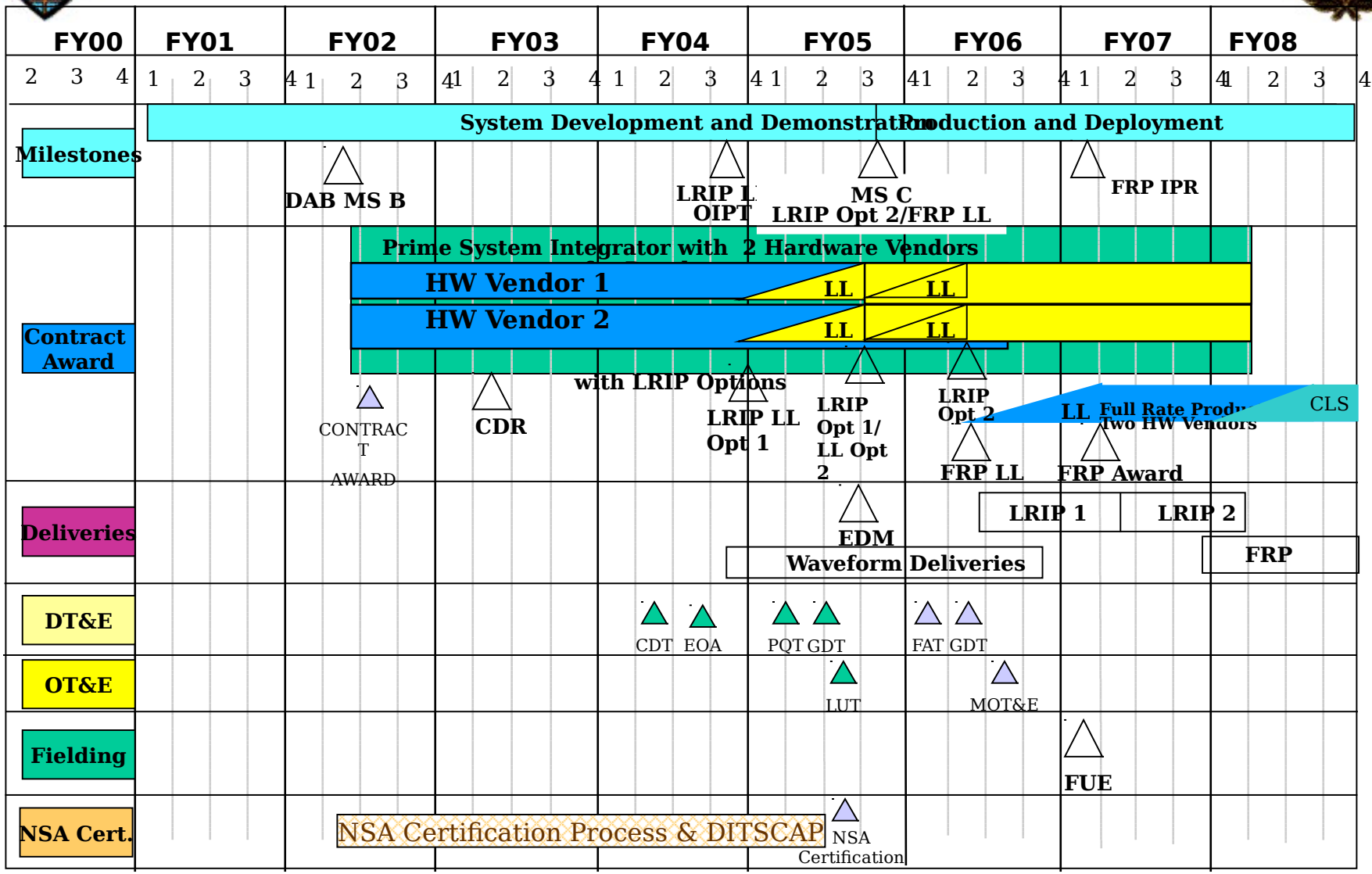
= DATA = VOICE/DATA = VOICE = KOPP

Cluster 1 Acquisition Concept



MULTIPLE SOURCES AND MAINTAIN COMPETITION

Cluster 1 Master Schedule



DT&E - Developmental Test and Evaluation
OT&E – Operational Test and Evaluation
EOA - Early Operational Test

FRP - Full Rate Production
FUE - First Unit Equipped
FAT - First Article Test

LRIP - Low Rate Initial Production
MS - Milestone Decision
PQT - Production Qualification Test

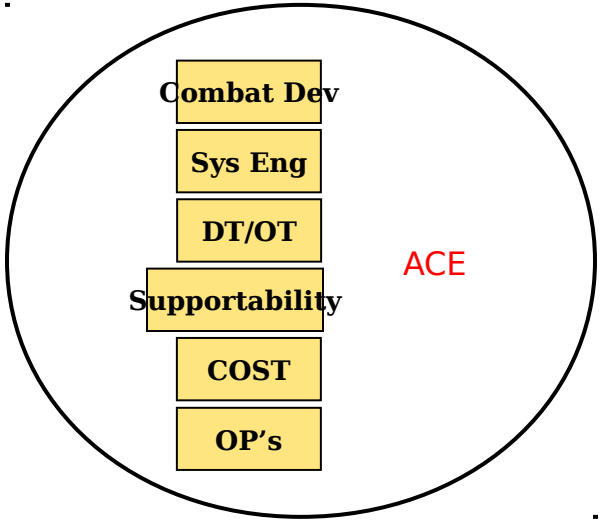
CDT - Government Developmental T
CDT - Contractor Development Test
LUT – Limited User Test

JTRS Cluster 1 Simulation Support Plan Version 2.0

SSP v 2.0

We organize M&S Opportunities into Six Domains

- Combat Development
- Systems Engineering
- DT / OT
- Supportability
- Cost Analysis
- Operational Uses



And wrap them with an *Advanced Collaborative Environment*

Opportunities by Domain

M&S may be used to aid in:

Combat Development
Determining/Validating/Refining Requirements
CONOPS and TTP Development
New Equipment Training

DT / OT
Test Planning and Design
Test Scenario Extension

Supportability
Spare Parts Provisioning
Maintenance Concept Evaluation
Human Interactive Studies

Systems Engineering
Collaborative Design
Subcomponent/Subassembly Testing
Finite Element Analysis
RF Effects Analysis
Software/Hardware Performance Analysis
Network/Waveform Performance Analysis
Technology Insertion/Evaluation

Cost Analysis
CAIV Analysis
Lifecycle Cost Analysis

Operational Use
Network Planning
Sustainment Training

The JTRS Advanced Collaborative Environment (ACE) supports cross-domain data reuse and geographically distributed efforts

Provide Support to Combat Development

Determine/Validate/Refine Requirements

CONOPS and TTP Development

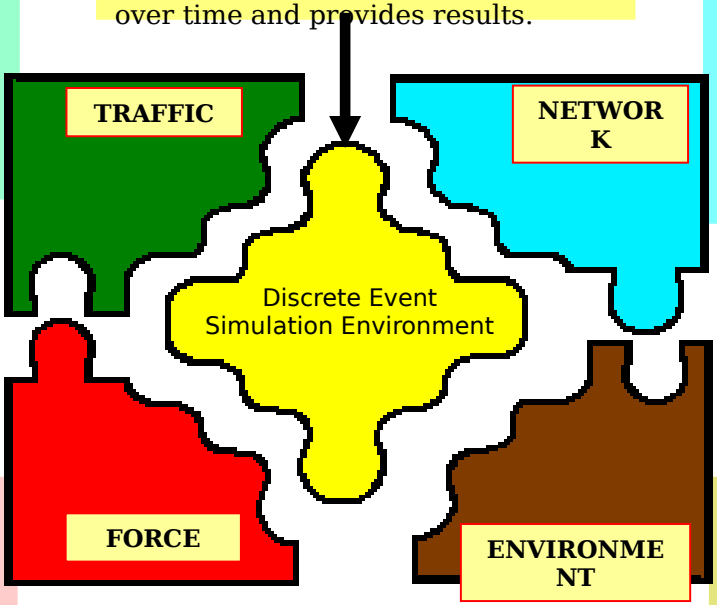
New Equipment Training

A Quick Look at Discrete Event Simulations

The DES environment provides the graphical front end and interfaces to integrate Traffic, Network, Force, and Environment models allowing them to interact. It runs the models over time and provides results.

The traffic represents all ***information exchanges*** (data, voice, video, etc.) between ***all*** communications nodes within the ***force***.

The network identifies all ***communications nodes*** (SINCGARS, EPLRS, LANs and multicast groups etc.) and their associated links (LAN, Radio, etc.) within the force and the ***switching***, ***routing***, ***relaying*** or ***transmission protocols*** utilized by them .



The force is a detailed representation of ***all C4I*** equipped ***platforms*** performing specific ***functions***. Each platform is located by ***map coordinates***.

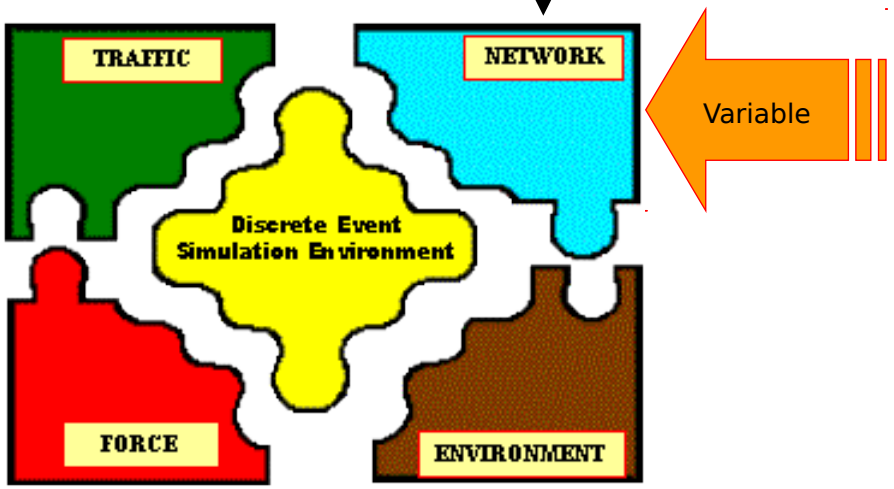
The environment represents the effect of ***vegetation, terrain, weather, other RF sources and man-made structures*** on the performance of RF propagation.

Determine/Validate/Refine Requirements

Requirements Documents

JTRS ORD
JTRS PRD
WNW FDD

Using Step 2C, NTDR and Commercial Protocols



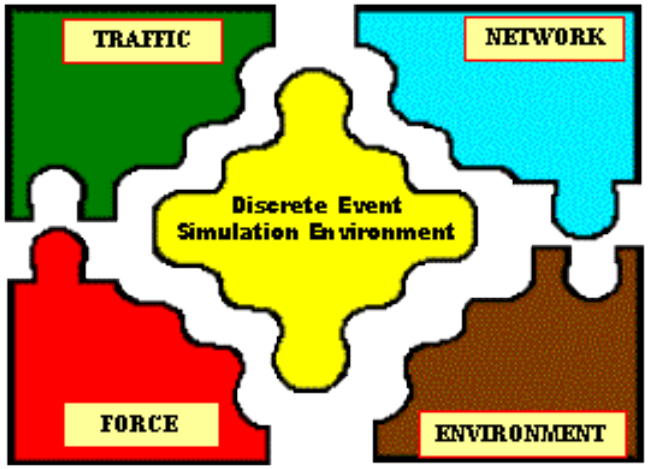
Is the specified requirement achievable?
Is the specified requirement sufficient?
Translate immeasurable requirements into measurable metrics.
New requirements derived.

Potential M&S Solutions

- Next Generation Performance Model (NGPM)
- OPNET Modeler
- QUALNET
- NETWARS

CONOPS & TTP Development

Variable



How does fielding an interoperable, multifunctional, adaptable, high capacity, wireless voice and data communications system effect how we conduct military operations?

How do we Install, Operate and Maintain the JTRS to optimize it's capabilities?

Potential M&S Solutions

- Next Generation Performance Model (NGPM)
- OPNET Modeler
- QUALNET
- NETWARS

New Equipment Training Tool

Click here for Diesel Engine Demo

Potential M&S Solutions

- TRADOC MMC
- NGB MIMIC

During System Development and Demonstration we utilize *Collaborative Design* to:

- Refine the Design
- Examine Production and Supportability Issues

We now add Multimedia and Interactive Enhancements to aid in:

- Training Operators
- Training Maintainers

Provide Support to the System Engineer

Collaborative Design

Subcomponent/Subassembly Testing

Finite Element Analysis

RF Effects Analysis

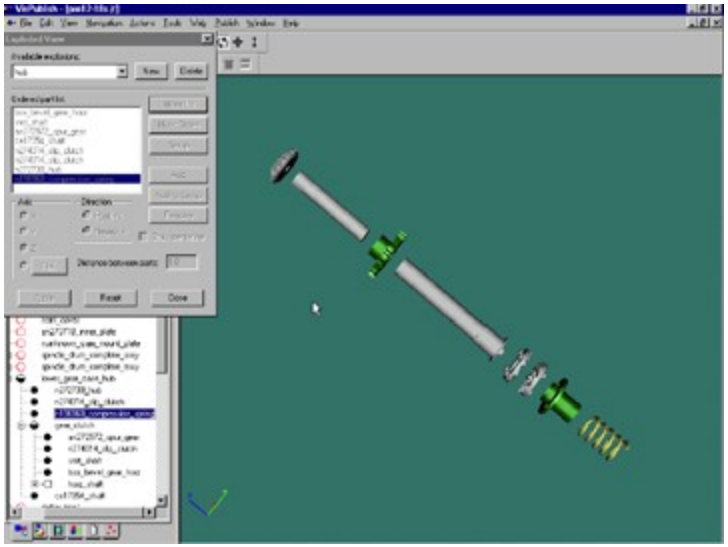
Software/Hardware Performance Analysis

Network/Waveform Performance Analysis

Technology Insertion/Evaluation

Collaborative Design

Click here for Design Demo



During System Development and Demonstration we utilize *Collaborative Design* to:

- Refine the Design
- Conduct Human Interactive Studies
- Examine Production and Supportability Issues

Potential M&S Solutions

- Pro/Engineer Desktop
- ENOVIA 3d com
- Vis VSA/Publish

Subcomponent Design/Testing

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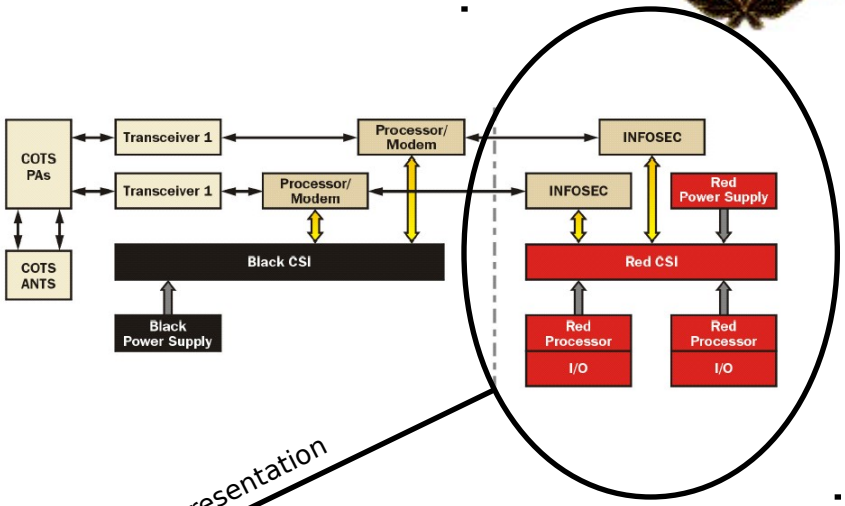
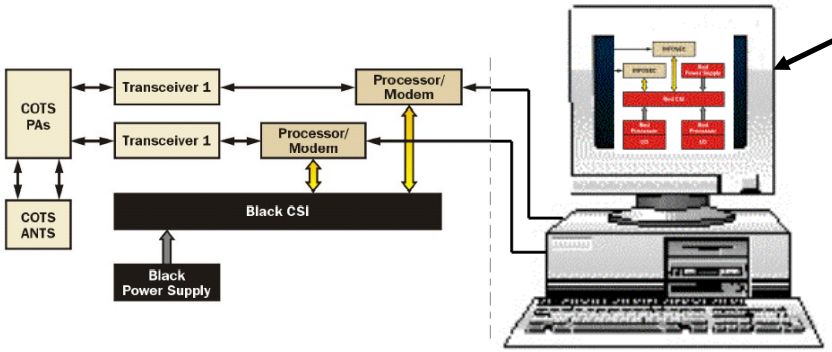


Virtual Representation



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How will the subcomponent perform when integrated?

Finite Element Analysis

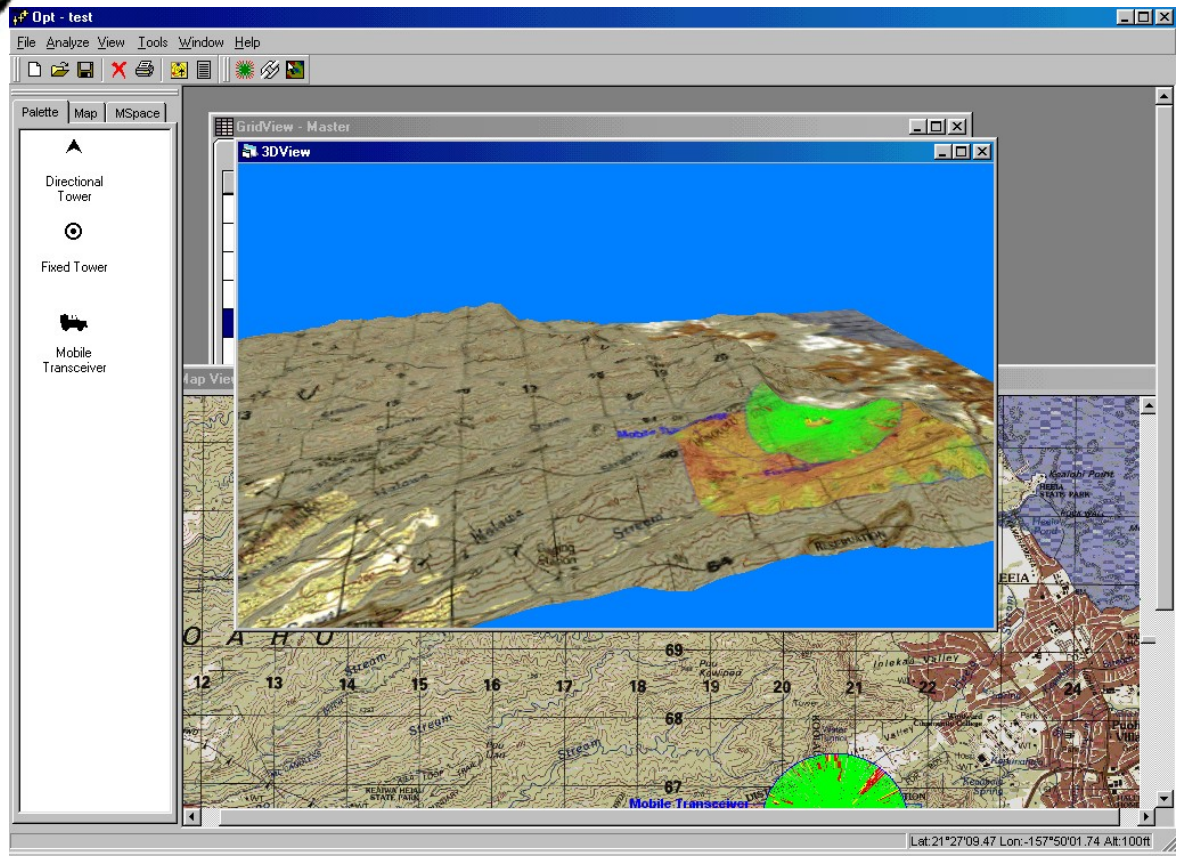
Conduct Early Analysis of JTRS ability to meet environmental performance requirements:

Altitude
Temperature
Solar Radiation
Humidity
Salt Fog
Rain
Sand and Dust
Explosive Atmosphere
Vibration
Shock
Ballistic Shock
Immersion
Air Drop
Acceleration

Potential M&S Solutions

- AMSAA Physic of Failure:
  - CADMP-II
  - CalcePWA

RF Analysis



Examine RF Issues:

- Co-Site Interference
- Interference with Legacy Radios
- Interference with Commercial and Government RF Sources
- Interference from Natural Phenomena
- Electronic Warfare
- Propagation in Various Environments (Terrain, Vegetation, Weather, Urban)

Potential M&S Solutions

- Electronic Battlefield Environment (EBE)
- COSAM V
- Link Assessment Model (LAM)
- Electromagnetic Engineering Workbench (EMEW)
- TIREM
- MITRE:
  - RF Connectivity Model
  - Cosite Interference Model

SW/HW Performance Analysis

Electronics Specification

IEEE
VHDL or
VERILOG

UNIFIED MODELING LANGUAGE UML™

Software Specification

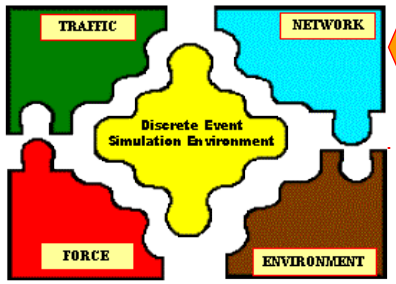
Simulate

How will the software perform?
How will the hardware perform?
Co-Verification Analysis

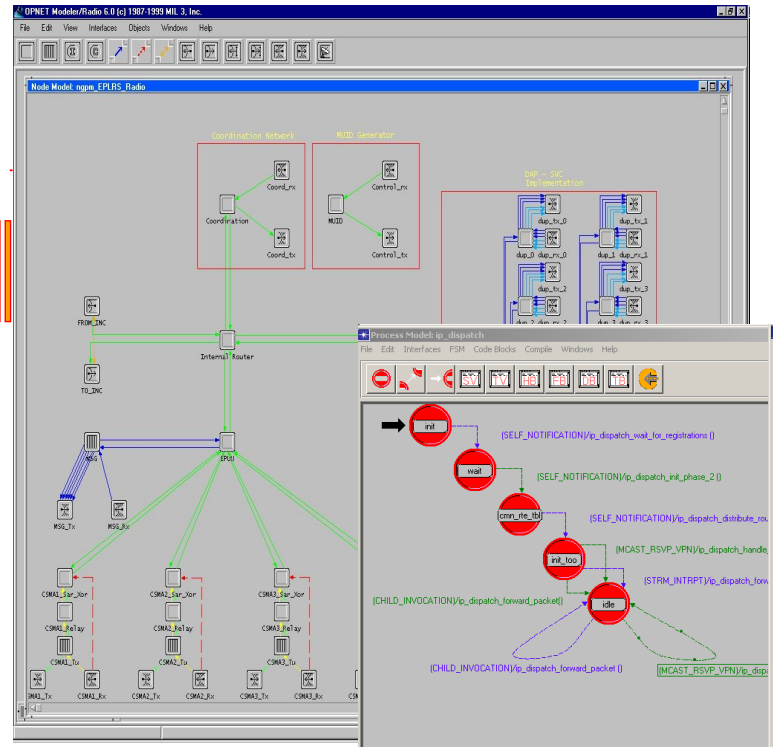
Potential M&S Solutions

- ModelSim
- ISpice
- SIMULINK
- Rational Quantify
- SEAMLESS
- Virtual-CPU
- EagleI
- N2C

Protocol Development



Variable


OPNET Modeler/Radio 6.0 (c) 1987-1999 MIL 3, Inc.
Node Model: ngpn_EPLRS_Radio
Process Model: ip_dispatch
ip_dispatch.function block

A small change here

Can have a tremendous impact here

How does a protocol change effect the network?

Multicast, Routing, QoS…

How does the protocol scale?

What are the trade-offs?

Potential M&S Solutions

- OPNET Modeler (JPO WNW M&S Committee Lead)

Technology Insertion Evaluation

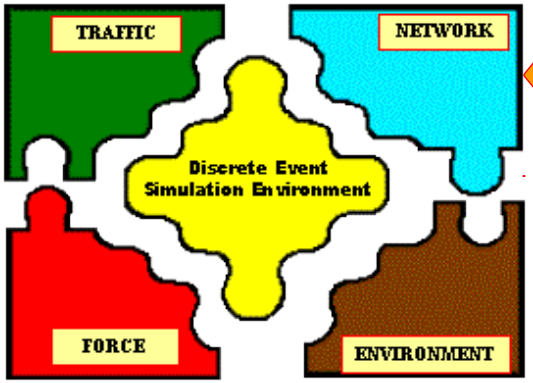
Reuse HiL/SiL and/or DES solutions to evaluate the potential benefits of technology insertion and evaluate a contractor’s proposal to insert new technology during the system development and demonstration phase of the JTRS life cycle.

Provide Support to Test and Evaluation

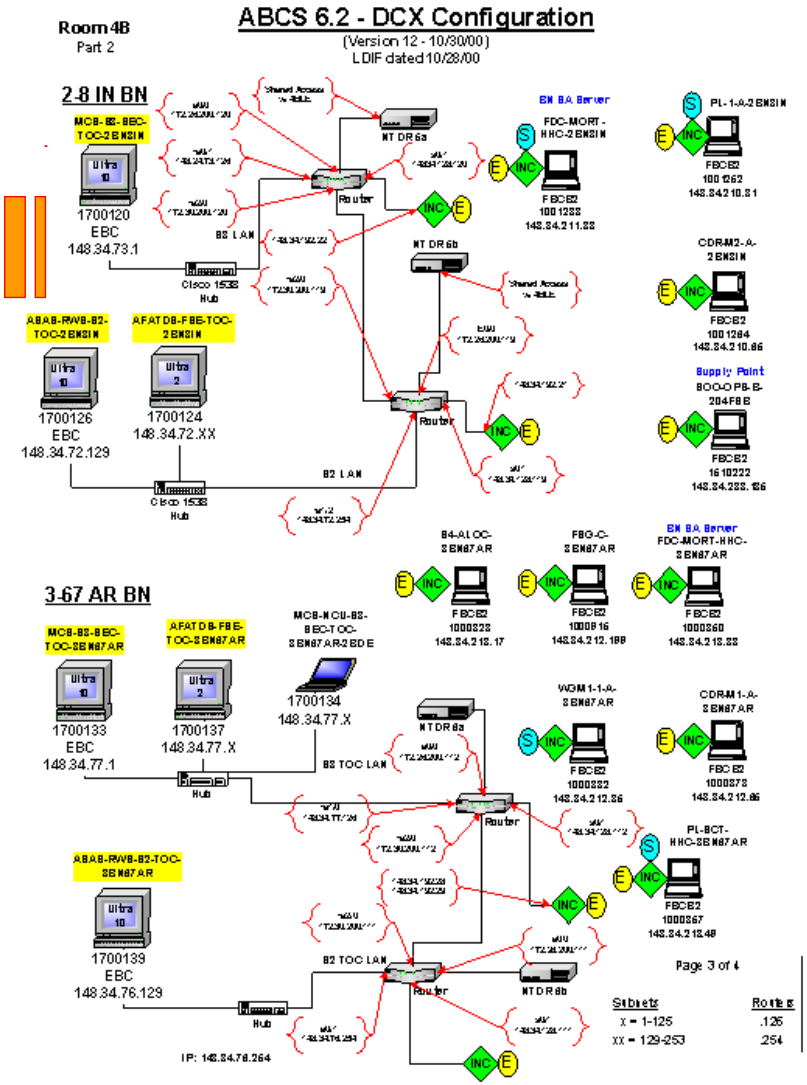
Test Planning and Design

Test Scenario Extension

Test Planning



Variable



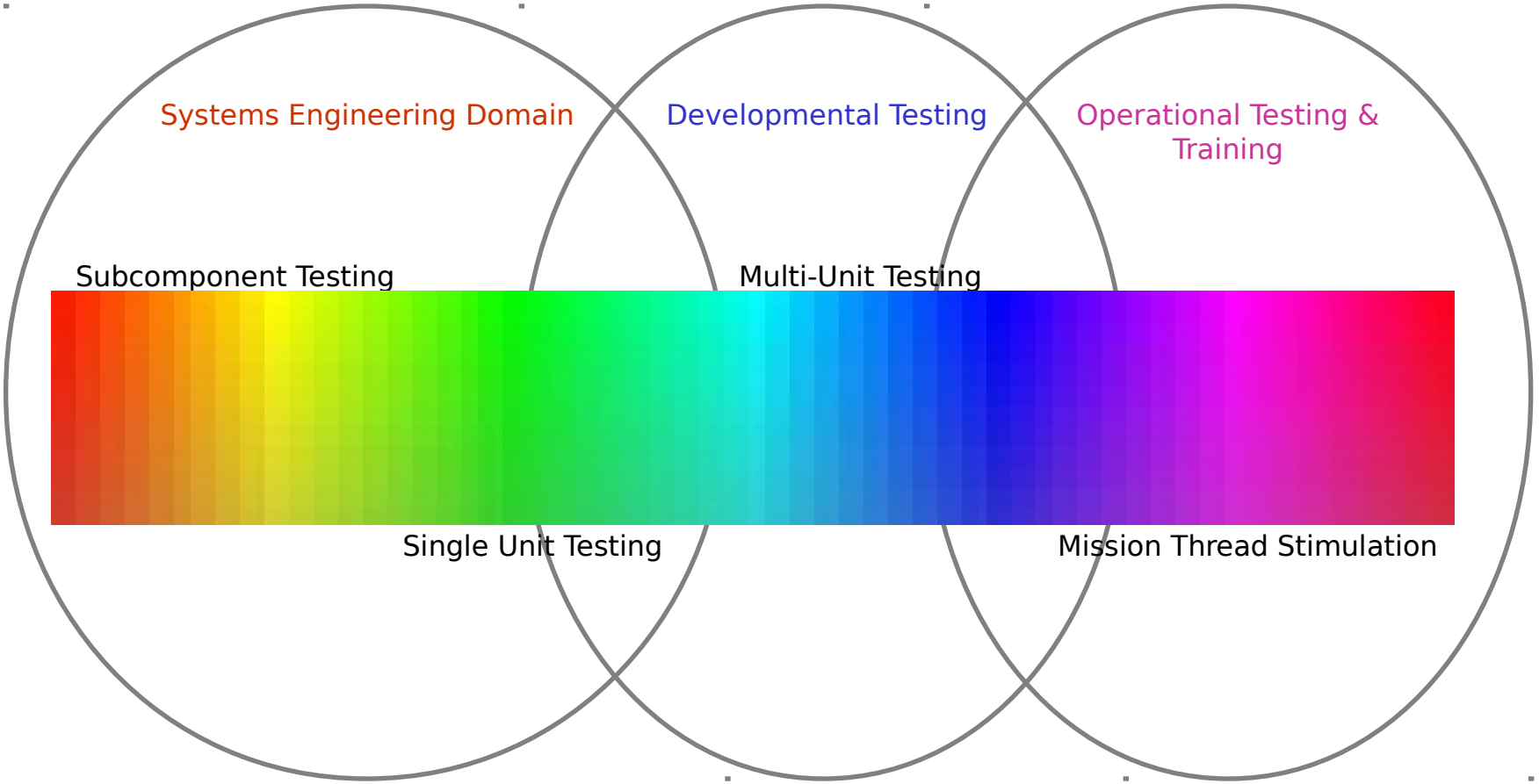
Will the Test Architecture work?
Does the Test Architecture provide the data needed?
Where do I need to focus my data collection?

Predicted performance measures are compared to test results to refine and validate the model.

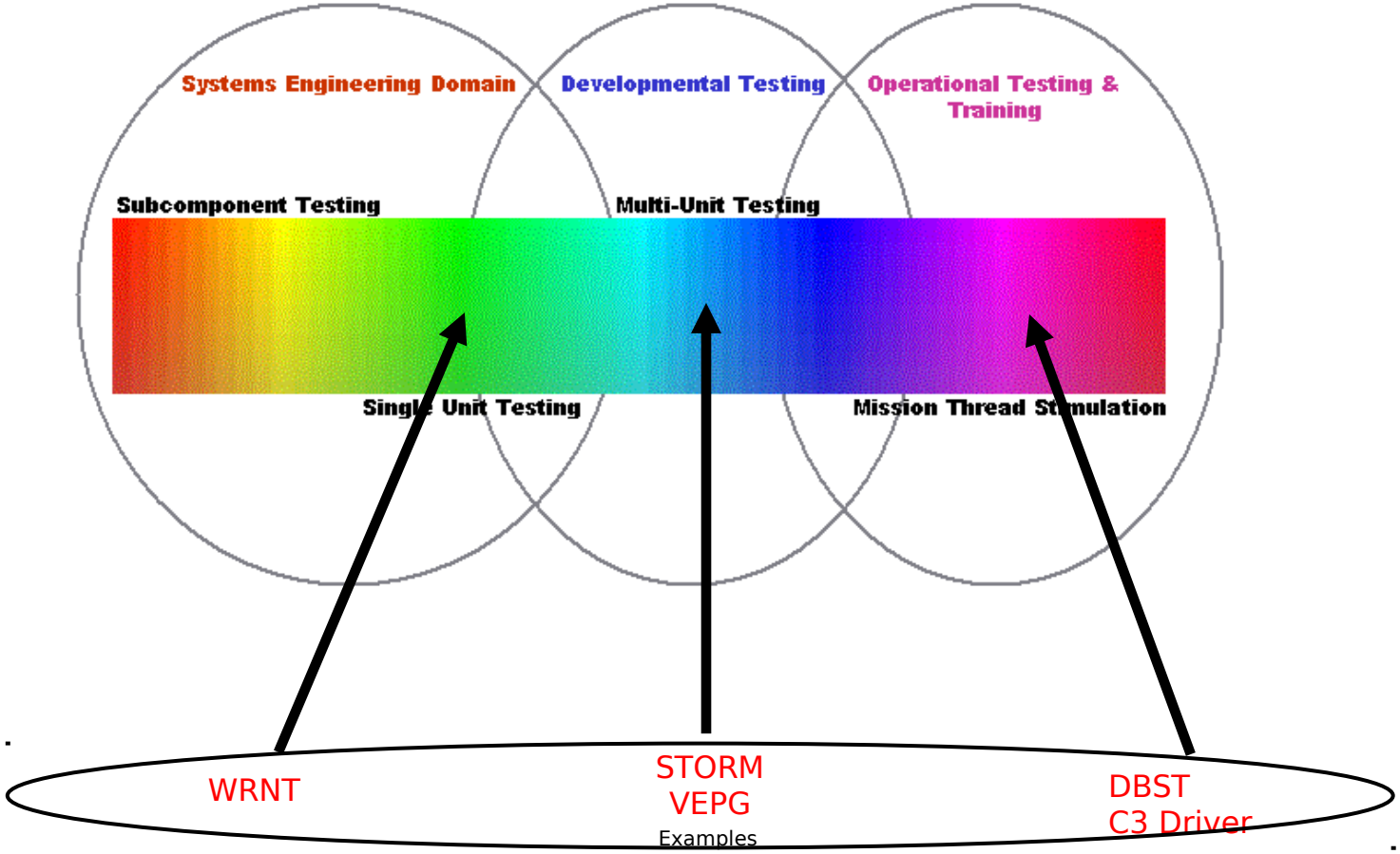
Potential M&S Solutions

- Next Generation Performance Model (NGPM)
- OPNET Modeler
- QUALNET

HiL/SiL is a Spectrum



We Identify Tools along the Spectrum



- M&S Tool Capabilities and Limitations
- VV&A Status
- Cost to IOM
- Required Modifications to Interface with the JTRS

To Serve as a Menu For DT/OT Architecture Development

What *questions* is the test to answer?

What *data* do I need to answer the questions?

What *architecture* do I need to produce the data?

M&S Menu

Can I reduce schedule, cost or risk or improve the quality or quantity of test data by utilizing an M&S tool in the test architecture?

Single Unit Testing

RF/EW Effects

Traffic Generator

AN/PSQ-6A EPLRS

AN/ARC-210

AN/WCS-3 UHF SATCOM/LOS

AN/ARC-201A SINCGARS

ANPRC-119 SINCGARS

AN/PSC-5

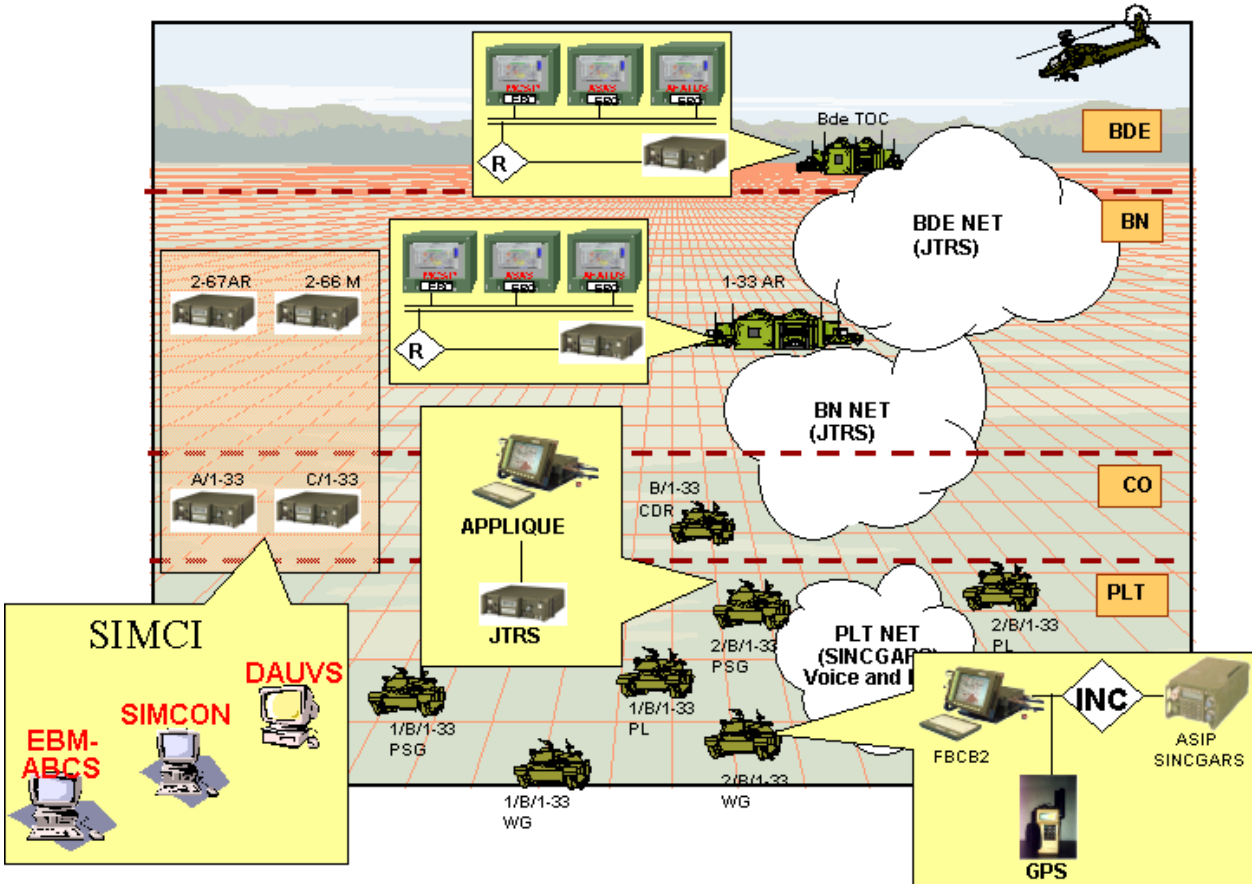
JTRS

- Over the air interoperability
- Communications range capabilities
- Retransmit between waveforms
- Data bridging
- Performance with Jamming/Interference
- Multi-Channel simultaneous operation
- Waveform compliance to standards/specifications

Potential M&S Solutions

- Wideband Radio Network Testbed (WRNT)
- Virtual Electronic Proving Ground (VEPG)

Multi-Unit Testing



Data performance issues in a busy network
Demonstrate IER's
Interoperability with host platforms
Co-Site Interference
WNW FDD Requirements

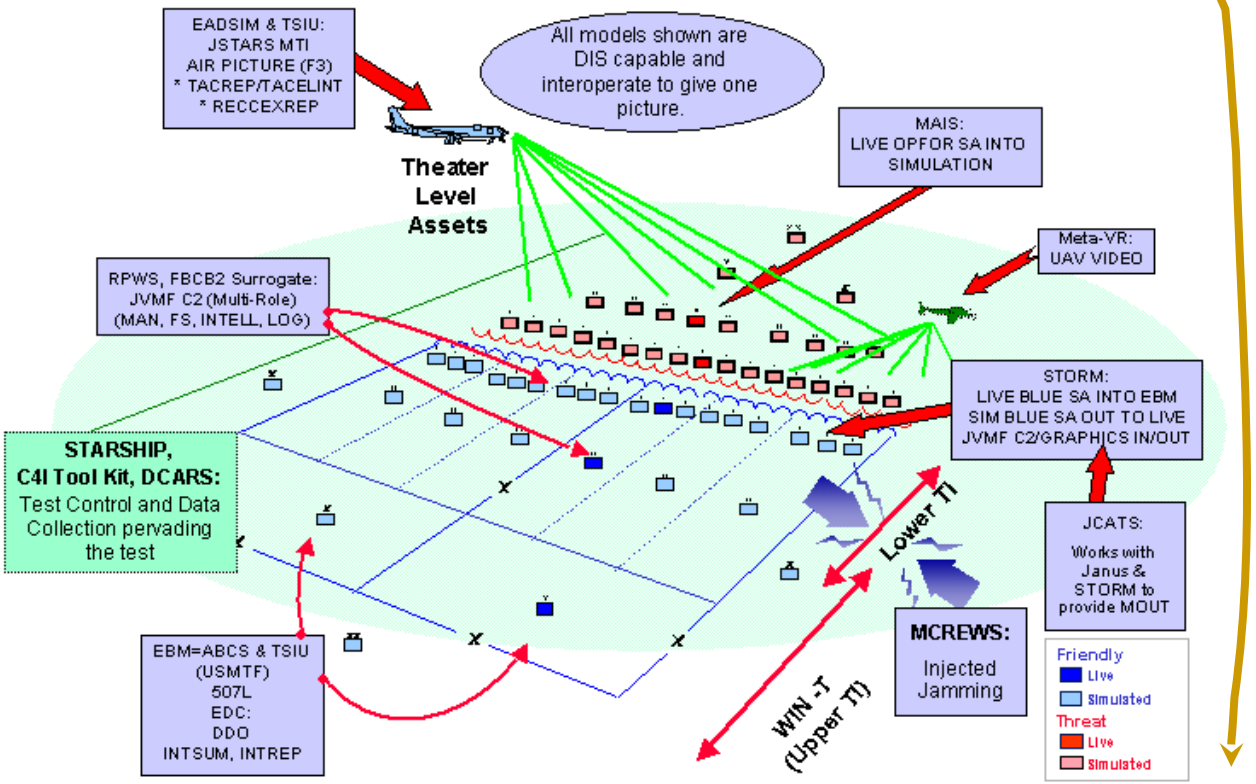
Potential M&S Solutions

- Simulation, Testing, Operations Rehearsal Model (STORM)
- Virtual Electronic Proving Ground (VEPG)
- WRNT

Mission Thread Stimulation

Realistic Mission Thread Stimulation

Concept: Live & Simulated Forces



Potential M&S Solutions

- Federated Simulations:
  - STORM
  - DBST
  - C3 Driver
- WARSIM
- oneSAF

- Critical Operational Issues and Criteria
- TTP Development
- Realistic Training Environment

Results in Realistic Information Exchange

Provide Support to Supportability Analysis

Spare Parts Provisioning

Maintenance Concept Evaluation

Human Interactive Studies

Supportability Studies

How do I maximize AVAILABILITY and minimize COST?

Trade-Offs between:

Spare Parts Provisioning(How many and where) – Cost -- Availability
Maintenance Concept(Who, when and where) – Cost -- Availability
System Design (Redundancy, LRU's, BITE) -- Cost -- Availability

Potential M&S Solutions

- COMPASS
- SESAME
- LCET

M&S is used to help determine the OPTIMUM solution

Human Interactive Studies

Click here for SONY Demo

During System Development and Demonstration we utilized *Collaborative Design* to:

- Refine the Design
- Examine Production and Supportability Issues

We now add limited interaction to conduct:

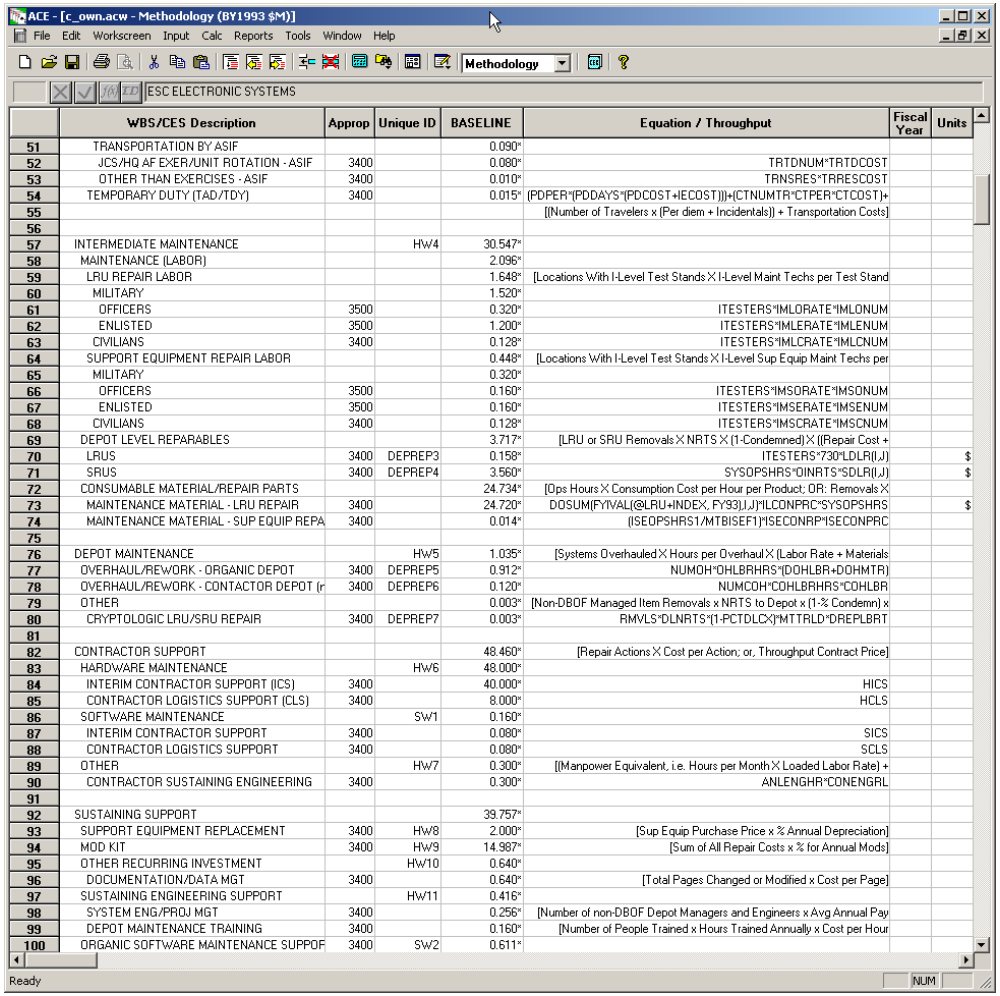
- Human Interactive Studies
- Interface Design Studies

Provide Support to Cost Analysis

CAIV Analysis

Lifecycle Cost Analysis

Cost Analysis


ACE - [c_own.acw - Methodology (BY1993 $M)]

File Edit Workscreen Input Calc Reports Tools Window Help

Methodology

ESC ELECTRONIC SYSTEMS

	WBS/CES Description	Approp	Unique ID	BASELINE	Equation / Throughput	Fiscal Year	Units
51	TRANSPORTATION BY ASIF			0.090*			
52	JCS/HQ AF EXER/UNIT ROTATION - ASIF	3400		0.080*	TRTDNUM*TRTDCOST		
53	OTHER THAN EXERCISES - ASIF	3400		0.010*	TRNSRES*TRRESCOST		
54	TEMPORARY DUTY (TAD/TDY)	3400		0.015*	(PDPER*(PDDAYS*(PDCOST+IECOST))+(CTNUMTR*CTPER*CTCOST)+		
55					[(Number of Travelers x (Per diem + Incidentals)) + Transportation Costs]		
56							
57	INTERMEDIATE MAINTENANCE		HW4	30.547*			
58	MAINTENANCE (LABOR)			2.096*			
59	LRU REPAIR LABOR			1.648*	[Locations With I-Level Test Stands X I-Level Maint Techs per Test Stand		
60	MILITARY			1.520*			
61	OFFICERS	3500		0.320*	ITESTERS*IMLORATE*IMLONUM		
62	ENLISTED	3500		1.200*	ITESTERS*IMLERATE*IMLENUM		
63	CIVILIANS	3400		0.128*	ITESTERS*IMLCRATE*IMLCNUM		
64	SUPPORT EQUIPMENT REPAIR LABOR			0.448*	[Locations With I-Level Test Stands X I-Level Sup Equip Maint Techs per		
65	MILITARY			0.320*			
66	OFFICERS	3500		0.160*	ITESTERS*IMSORATE*IMSONUM		
67	ENLISTED	3500		0.160*	ITESTERS*IMSERATE*IMSENUM		
68	CIVILIANS	3400		0.128*	ITESTERS*IMSCRATE*IMSCNUM		
69	DEPOT LEVEL REPARABLES			3.717*	[LRU or SRU Removals X NRTS X (1-Condemned) X ((Repair Cost +		
70	LRUS	3400	DEPREP3	0.158*	ITESTERS*730*LDLR(I,J)		$
71	SRUS	3400	DEPREP4	3.560*	SYSOPSHRS*0INRTS*SDLR(I,J)		$
72	CONSUMABLE MATERIAL/REPAIR PARTS			24.734*	[Ops Hours X Consumption Cost per Hour per Product; OR: Removals X		
73	MAINTENANCE MATERIAL - LRU REPAIR	3400		24.720*	DOSUM(FYIVAL[@LRU+INDEX, FY93],I,J)*ILCONPRC*SYSOPSHRS		$
74	MAINTENANCE MATERIAL - SUP EQUIP REPA	3400		0.014*	(ISEOPSHRS1/MTBISEF1)*ISECONRP*ISECONPRC		
75							
76	DEPOT MAINTENANCE		HW5	1.035*	[Systems Overhauled X Hours per Overhaul X (Labor Rate + Materials		
77	OVERHAUL/REWORK - ORGANIC DEPOT	3400	DEPREP5	0.912*	NUMOH*OHLBRHRS*(DOHLBR+DOHMTR)		
78	OVERHAUL/REWORK - CONTACTOR DEPOT (r	3400	DEPREP6	0.120*	NUMCOH*COHLBRHRS*COHLBR		
79	OTHER			0.003*	[Non-DBOF Managed Item Removals x NRTS to Depot x (1-% Condemn) x		
80	CRYPTOLOGIC LRU/SRU REPAIR	3400	DEPREP7	0.003*	RMVLS*DLNRTS*(1-PCTDLCX)*MTTRLD*DREPLBRT		
81							
82	CONTRACTOR SUPPORT			48.460*	[Repair Actions X Cost per Action; or, Throughput Contract Price]		
83	HARDWARE MAINTENANCE		HW6	48.000*			
84	INTERIM CONTRACTOR SUPPORT (ICS)	3400		40.000*	HICS		
85	CONTRACTOR LOGISTICS SUPPORT (CLS)	3400		8.000*	HCLS		
86	SOFTWARE MAINTENANCE		SW1	0.160*			
87	INTERIM CONTRACTOR SUPPORT	3400		0.080*	SICS		
88	CONTRACTOR LOGISTICS SUPPORT	3400		0.080*	SCLS		
89	OTHER		HW7	0.300*	[(Manpower Equivalent, i.e. Hours per Month X Loaded Labor Rate) +		
90	CONTRACTOR SUSTAINING ENGINEERING	3400		0.300*	ANLENGHR*CONENGRL		
91							
92	SUSTAINING SUPPORT			39.757*			
93	SUPPORT EQUIPMENT REPLACEMENT	3400	HW8	2.000*	[Sup Equip Purchase Price x % Annual Depreciation]		
94	MOD KIT	3400	HW9	14.987*	[Sum of All Repair Costs x % for Annual Mods]		
95	OTHER RECURRING INVESTMENT		HW10	0.640*			
96	DOCUMENTATION/DATA MGT	3400		0.640*	[Total Pages Changed or Modified x Cost per Page]		
97	SUSTAINING ENGINEERING SUPPORT		HW11	0.416*			
98	SYSTEM ENG/PROJ MGT	3400		0.256*	[Number of non-DBOF Depot Managers and Engineers x Avg Annual Pay		
99	DEPOT MAINTENANCE TRAINING	3400		0.160*	[Number of People Trained x Hours Trained Annually x Cost per Hour		
100	ORGANIC SOFTWARE MAINTENANCE SUPPOF	3400	SW2	0.611*			

Ready NUM

CAIV Studies

Lifecycle Cost Analysis

-- LCC estimate
-- Trade-off analyses
-- Repair level analyses
-- Production rate and quantity analyses
-- Warranty analyses
-- Spares provisioning
-- Resource projections
-- Risk and uncertainty analyses
-- Cost driver sensitivity analyses
-- Reliability growth analyses
-- Operational availability analyses
-- Spares optimization

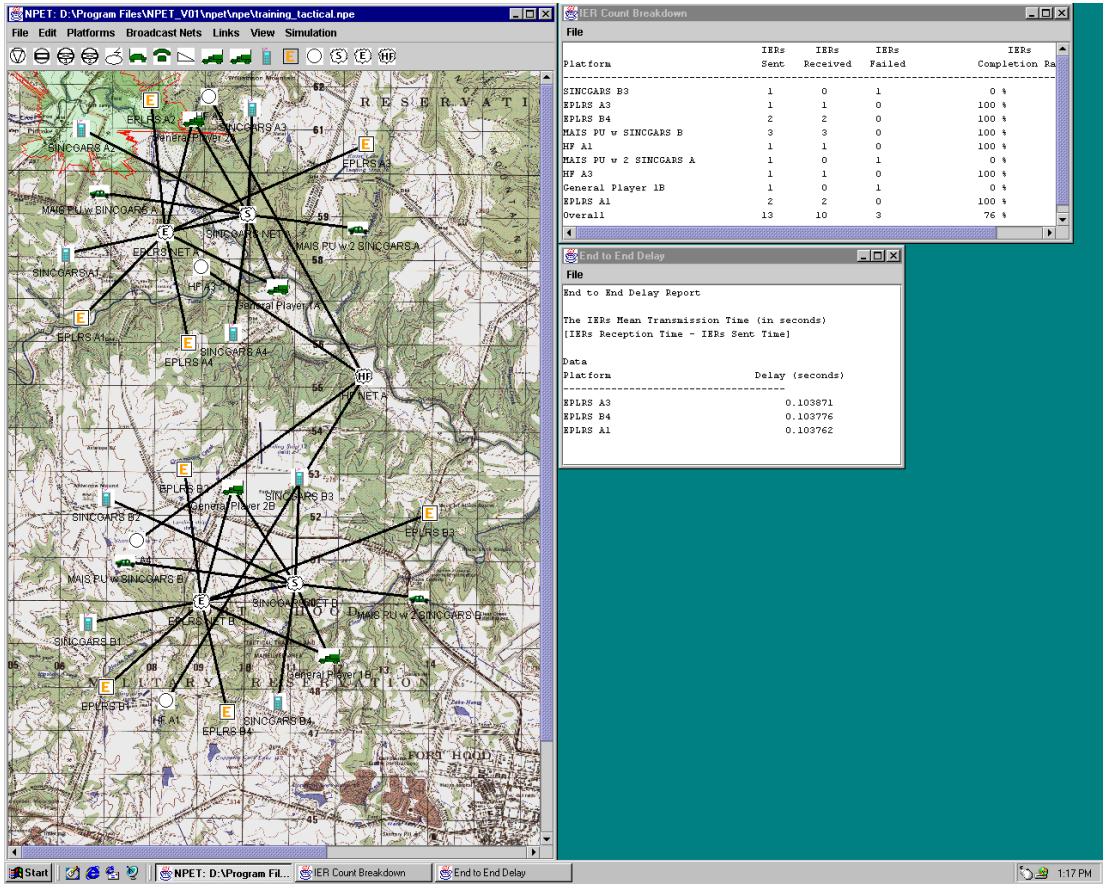
Potential M&S Solutions

- ACEIT
- LCET

Provide Support to Operational Users

Network Planning
Sustainment Training

Network Planning


NPET: D:\Program Files\NPET_V01\npet\npe\training_tactical.npe
File Edit Platforms Broadcast Nets Links View Simulation
IER Count Breakdown
File
Platform | IERs Sent | IERs Received | IERs Failed | IERs Completion Ra
SINCGARS B3 1 0 1 0 %
EPLRS A3 1 1 0 100 %
EPLRS B4 2 2 0 100 %
MAIS PU w SINCGARS B 3 3 0 100 %
HF A1 1 1 0 100 %
MAIS PU w 2 SINCGARS A 1 0 1 0 %
HF A3 1 1 0 100 %
General Player 1B 1 0 1 0 %
EPLRS A1 2 2 0 100 %
Overall 13 10 3 76 %
End to End Delay
File
End to End Delay Report
The IERs Mean Transmission Time (in seconds)
[IERs Reception Time - IERs Sent Time]
Data
Platform Delay (seconds)
EPLRS A3 0.103871
EPLRS B4 0.103776
EPLRS A1 0.103762
Start
NPET: D:\Program Fil...
IER Count Breakdown
End to End Delay
1:17 PM

Where do I place my communications nodes?
Will I have LOS?
What is my expected throughput, delay, completion rate, etc.?

Potential M&S Solutions

- NPET
- SPEED
- OPSIM
- NETWARS
- JNMS

Sustainment Training Tool

Click here for SINCGARS Course Demo

Potential M&S Solutions

- TRADOC MMC
- NGB MIMIC

During System Development and Demonstration we utilize *Collaborative Design* to:

- Refine the Design
- Examine Production and Supportability Issues

We added Multimedia and Interactive Enhancements to aid in:

- Training Operators
- Training Maintainers

To support *New Equipment Training*

We now package it and/or Web enable the content to:

- Train Operators
- Train Maintainers

To support *Sustainment Training*

Establish an Advanced Collaborative Environment

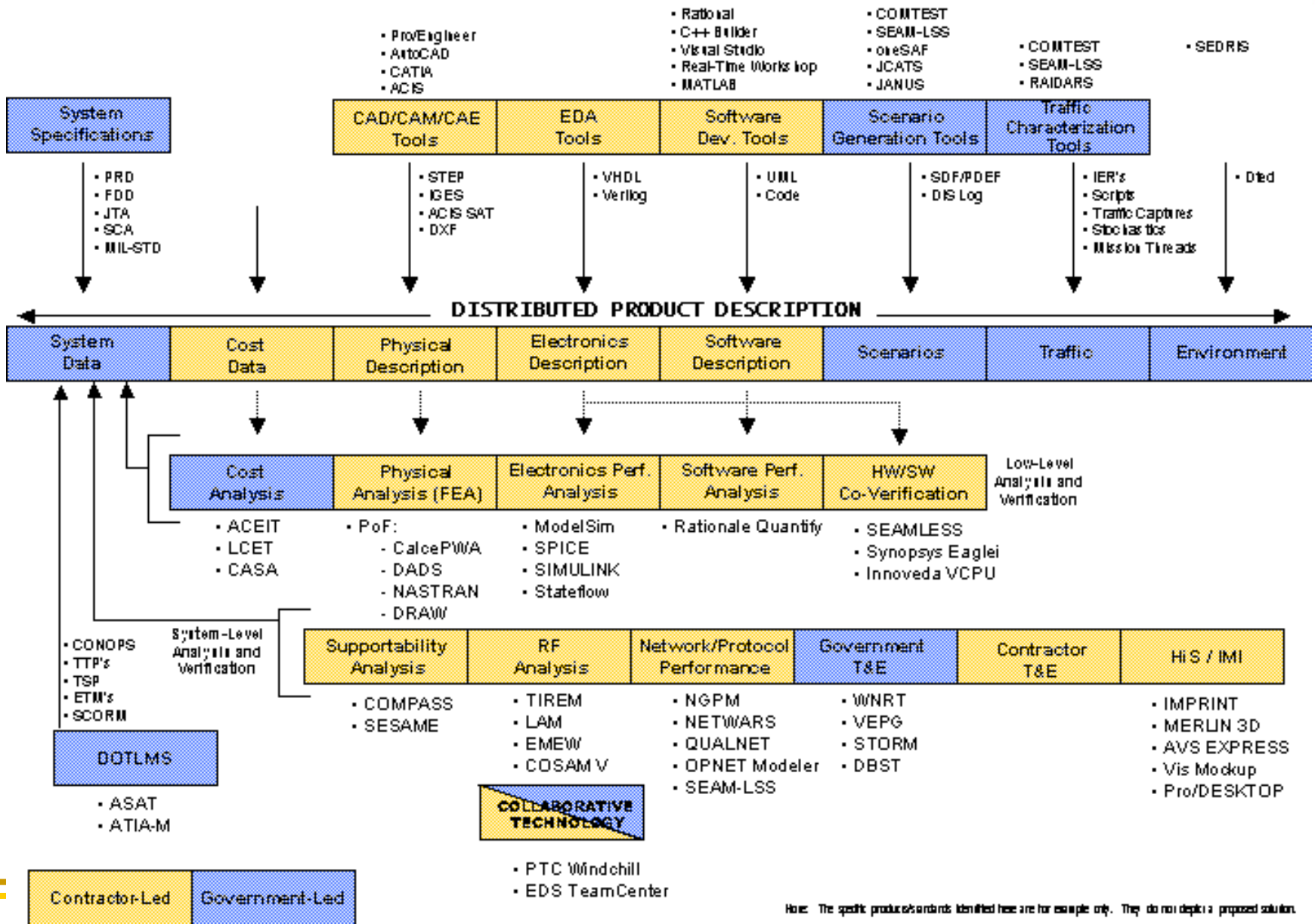
Electronics

Hardware

Software

Data is Shared and Visualized

JTRS ACE

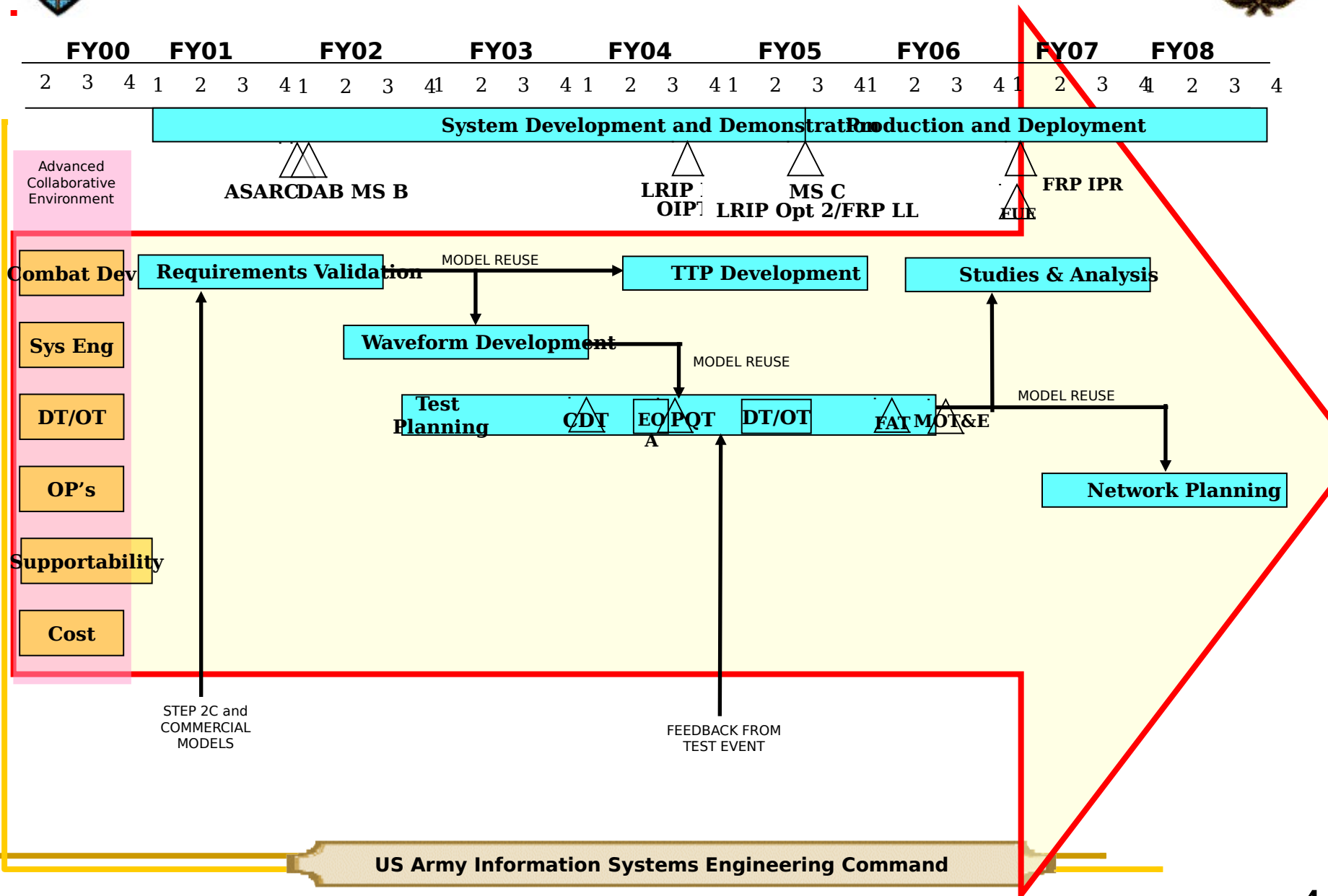

• Pro/Engineer
• AutoCAD
• CATIA
• ACIS
• Rational
• C++ Builder
• Visual Studio
• Real-Time Workshop
• MATLAB
• COMTEST
• SEAM-LSS
• oneSAF
• JCATS
• JANUS
• COMTEST
• SEAM-LSS
• RAIDARS
• SEDRIS
System Specifications
CAD/CAM/CAE Tools
EDA Tools
Software Dev. Tools
Scenario Generation Tools
Traffic Characterization Tools
• PRD
• FDD
• JTA
• SCA
• MIL-STD
• STEP
• IGES
• ACIS SAT
• DXF
• VHDL
• Verilog
• UML
• Code
• SDF/PDEF
• DIS Log
• IER's
• Scripts
• Traffic Captures
• Stochastics
• Mission Threads
• Dted
DISTRIBUTED PRODUCT DESCRIPTION
System Data
Cost Data
Physical Description
Electronics Description
Software Description
Scenarios
Traffic
Environment
Cost Analysis
Physical Analysis (FEA)
Electronics Perf. Analysis
Software Perf. Analysis
HW/SW Co-Verification
Low-Level Analysis and Verification
• ACEIT
• LCET
• CASA
• PoF:
- CalcePWA
- DADS
- NASTRAN
- DRAW
• ModelSim
• SPICE
• SIMULINK
• Stateflow
• Rationale Quantify
• SEAMLESS
• Synopsys Eaglei
• Innoveda VCPU
System-Level Analysis and Verification
Supportability Analysis
RF Analysis
Network/Protocol Performance
Government T&E
Contractor T&E
HiS / IMI
• CONOPS
• TTP's
• TSP
• ETM's
• SCORM
• COMPASS
• SESAME
• TIREM
• LAM
• EMEW
• COSAM V
• NGPM
• NETWARS
• QUALNET
• OPNET Modeler
• SEAM-LSS
• WNRT
• VEPG
• STORM
• DBST
• IMPRINT
• MERLIN 3D
• AVS EXPRESS
• Vis Mockup
• Pro/DESKTOP
DOTLMS
• ASAT
• ATIA-M
COLLABORATIVE TECHNOLOGY
• PTC Windchill
• EDS TeamCenter
Contractor-Led
Government-Led
Note: The specific products/standards identified here are for example only. They do not depict a proposed solution.

DES Thrust

Discrete Event Simulations will support:

- Determining / Validating / Refining Requirements
- CONOPS and TTP Development
- Network/Waveform Performance Analysis
- Evaluating a Technology Insertion
- Test Planning and Design
- Network Planning

DES Thrust


FY00
FY01
FY02
FY03
FY04
FY05
FY06
FY07
FY08
2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4
System Development and Demonstration
Production and Deployment
Advanced Collaborative Environment
ASARC
DAB MS B
LRIP
OIP
MS C
LRIP Opt 2/FRP LL
FRP IPR
FUE
Combat Dev
Requirements Validation
MODEL REUSE
TTP Development
Studies & Analysis
Sys Eng
Waveform Development
MODEL REUSE
DT/OT
Test Planning
CDT
EOA
POT
DT/OT
FAT
MOT&E
MODEL REUSE
OP's
Network Planning
Supportability
Cost
STEP 2C and COMMERCIAL MODELS
FEEDBACK FROM TEST EVENT

HiL/SiL Thrust

HiL/SiL Simulation will support:

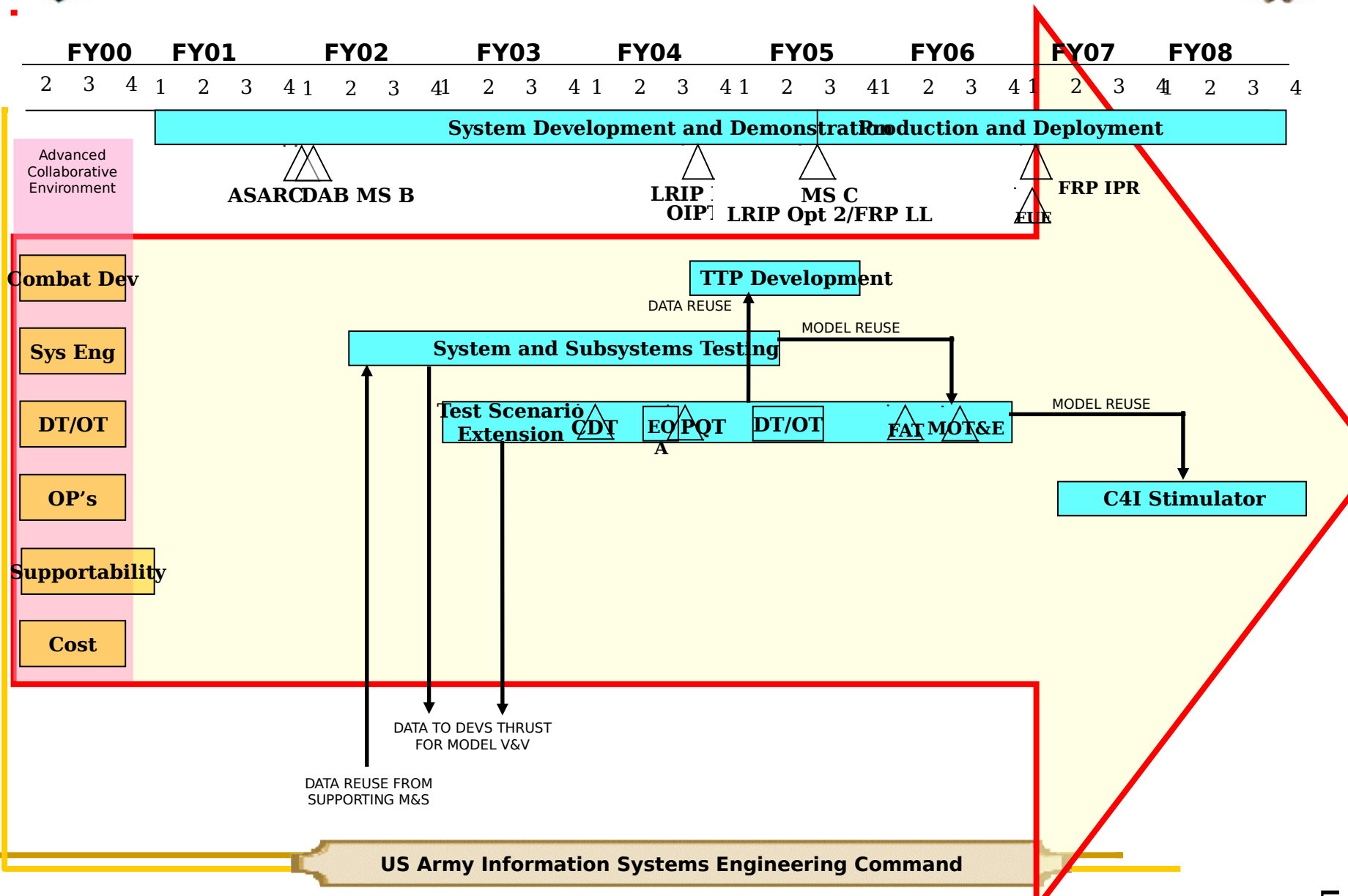
CONOPS and TTP Development

System and Subsystems Testing

Test Scenarios Extension

Training

HiL/SiL Thrust

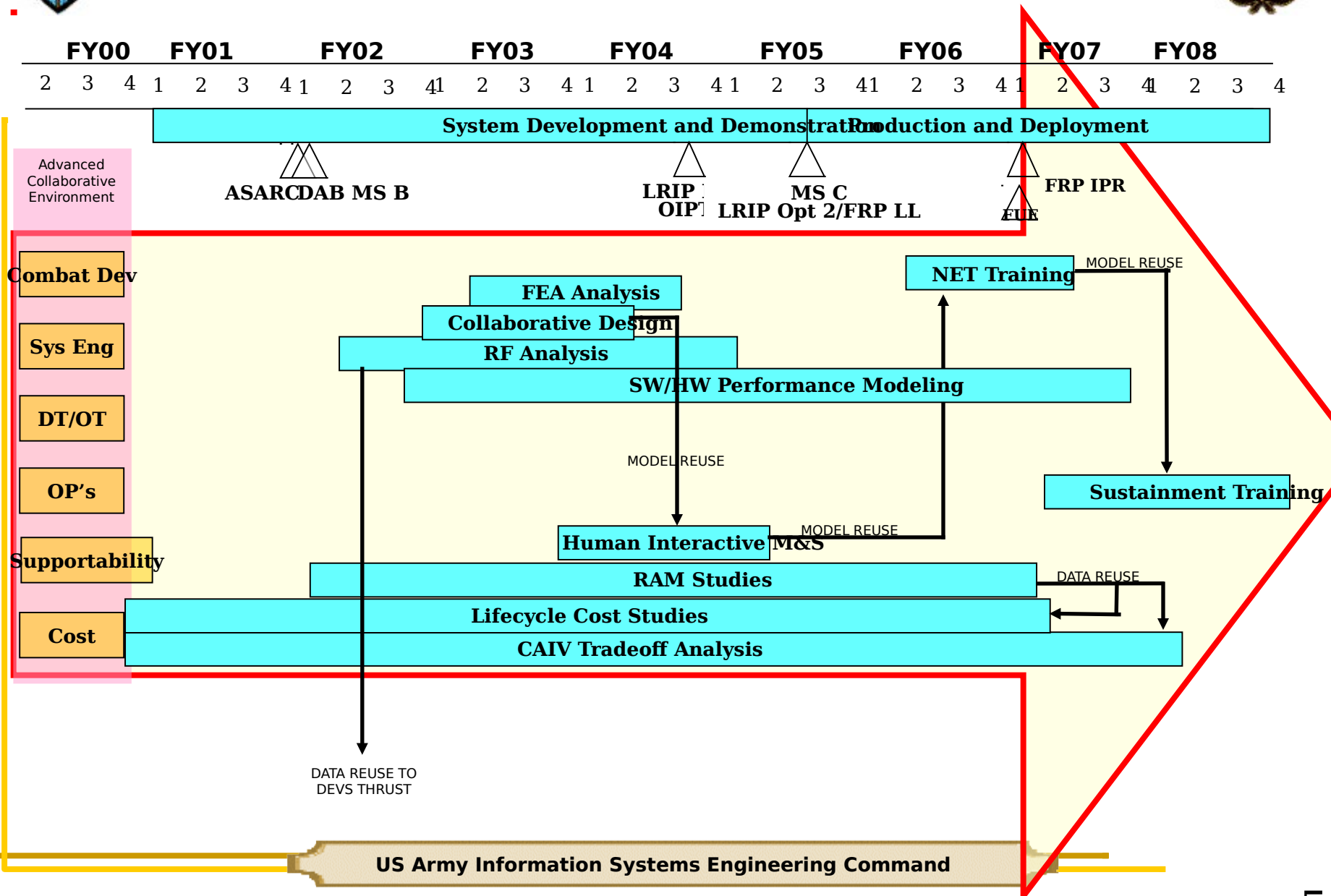


Supporting M&S

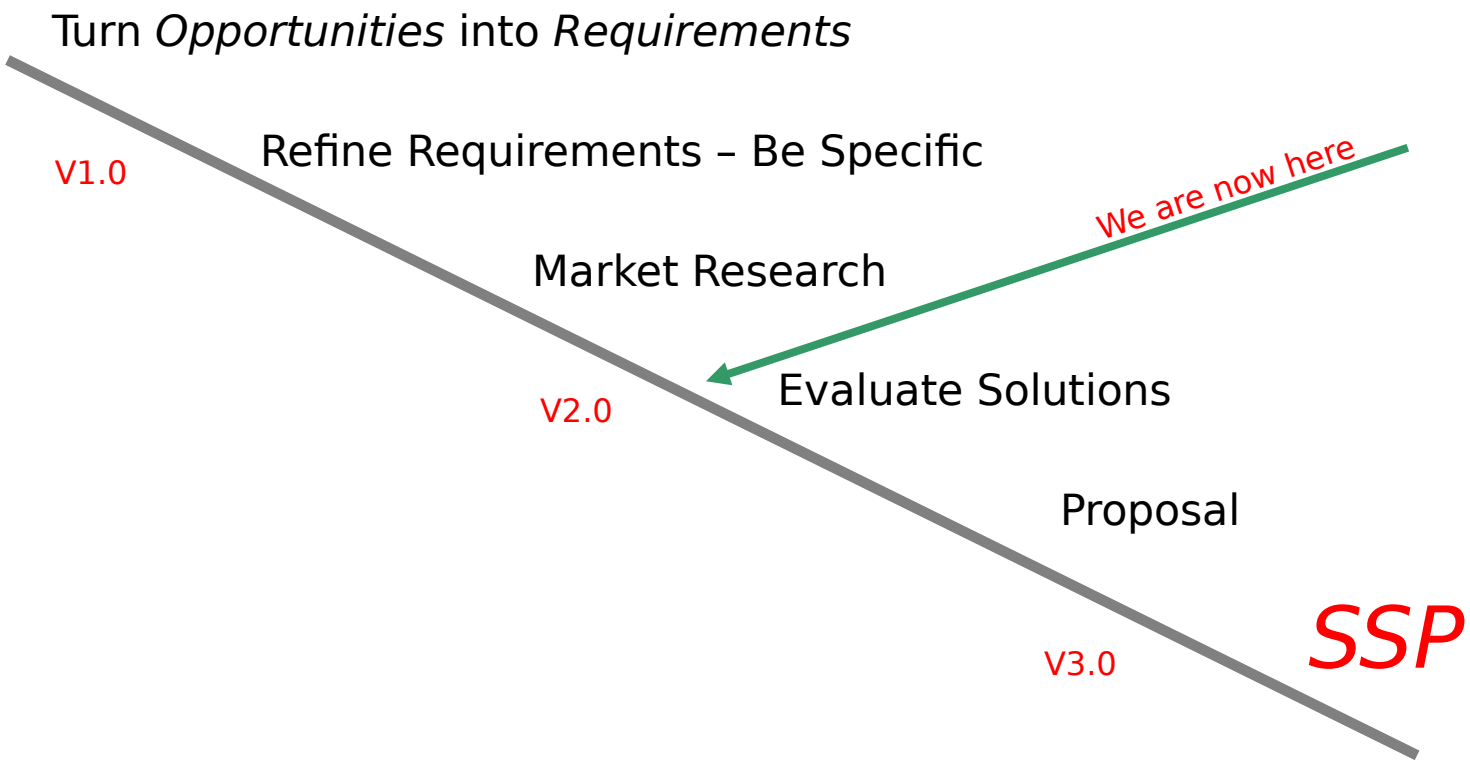
Supporting M&S will support:

Collaborative Design
Human Interactive Studies
New Equipment Training
Sustainment Training
Evaluating a Technology Insertion
Finite Element Analysis
RF Effects Analysis
SW/HW Performance Analysis
CAIV Tradeoff Analysis
Lifecycle Cost Analysis
Spare Parts Provisioning
Maintenance Concept Evaluation

Supporting M&S



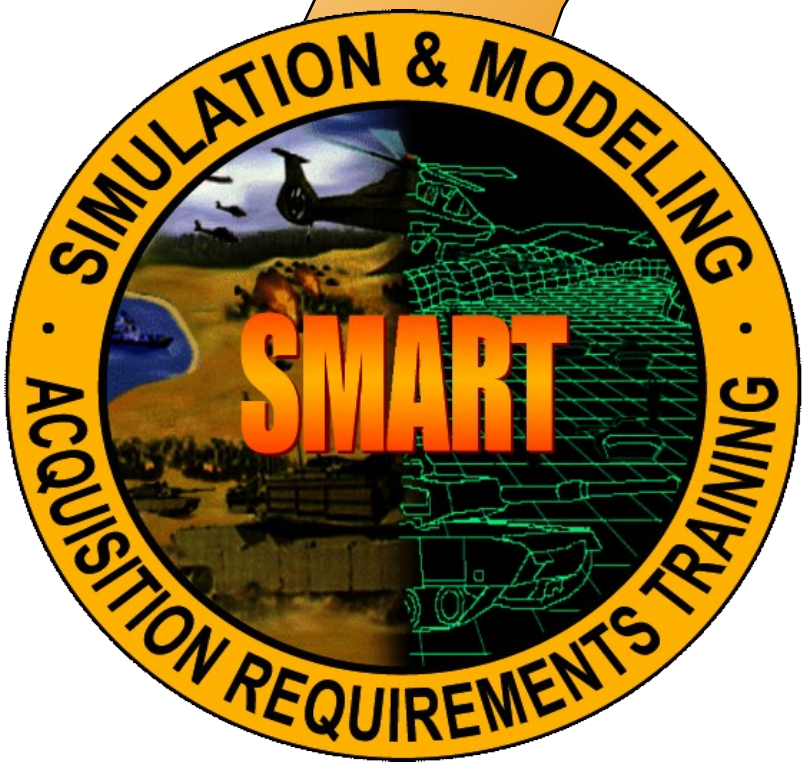
The Road Ahead



BACKUP SLIDES

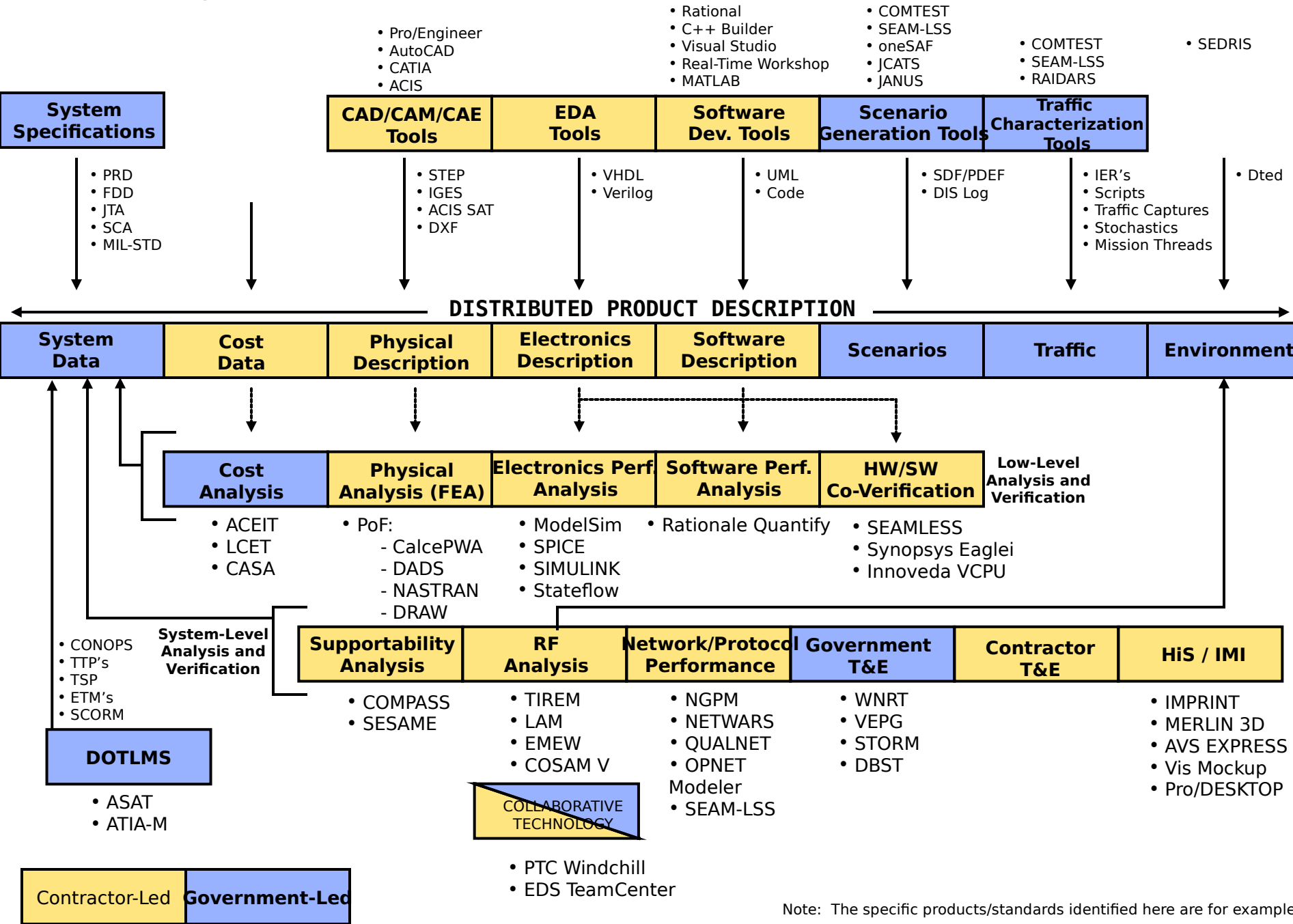
JTRS SMART Laboratory Concept

SMART Definition



SMART is a process in which we capitalize on Modeling and Simulation (M&S) technology to address the issue of system development and life-cycle costs through the combined efforts of the requirements, training and acquisition communities.

JTRS Cluster 1 Advanced Collaborative Environme



Note: The specific products/standards identified here are for example o

Cost Analysis Workstation

Tools in use:

- Advanced Cost Estimating Integrated Toolkit (ACEIT)
  - ACEIT is modeling environment that allows users to include all relevant costs (by life-cycle phase) in a tailored WBS for their unique system.
- Lifecycle Cost Estimating Tool (LCET)

Network Performance Analysis Workstation

Tools in use:

- OPNET Modeler
  - A discrete event modeling and simulation environment for the representation and analysis of computer and communications networks.
- Next Generation Performance Model (NGPM)
  - The NGPM consists of an integrated tool suite of Optimized Network Engineering Tools (OPNET) models and will provide a next-generation performance modeling capability in support of ongoing Army digitization efforts.
- NETWARS
  - NETWARS is a government-sponsored effort to develop improved M&S capabilities for measurement and assessment of information flow in military communications networks (tactical, operational, and strategic). Its principal use is to provide quantitative assessments to support budgets, high-level acquisitions, and policy deliberations but it's design is intended to provide the Warfighter the ability to perform communications planning, assessment of proposed communications technologies, and the communications supportability of new operational concepts.
- QualNet
  - QualNet, a product developed by Scalable Network Technologies (SNT), grew out of a research project at UCLA funded by the US Department of Defense Advanced Research Projects Agency (DARPA). Originally designed to model wireless ad-hoc networks, GloMoSim is the name of the core engine on which QualNet was based.
- SEAM-LSS
- System Performance Model (SPM)

Hardware / Software Performance Analysis Workstation

Tools in use:

- ModelSim
  - Verilog/VHDL simulator.
- Rationale Quantify
  - A performance profiling tool that automatically pinpoints application performance bottlenecks which supports performance tuning. Quantify also delivers repeatable timing data for all parts of an application, including components, not just the parts for which you have the source code
- SEAMLESS
  - Seamless is a virtual prototyping tool that enables embedded code execution against a Verilog or VHDL hardware simulation.
- MATLAB/SIMULINK/STATEFLOW

RF and FEA Analysis Workstation

Tools in use:

AMSAA Physic of Failure (PoF) Tool Set

- NASTRAN is a general-purpose finite element analysis tool based on NASA's popular NASTRAN finite element analysis software.
- CalcePWA
- DADS
- DRAW

- Electronic Battlefield Environment (EBE)
  - The EBE is a Common High Performance Computing Software Support Initiative (CHSSI) project to develop a portfolio of RF modeling tools.
- COSAM V
  - Joint Spectrum Center (JSC) tool used to predict the performance of communications and radar receivers operating in a co-site environment of conventional, frequency-hopping, direct-sequence, and radar transmitters.
- TIREM
- Link Assessment Model (LAM)
- Electromagnetic Engineering Workbench (EMEW)
  - M&S of RF environments using a dynamic, user-friendly and extensible software workbench. The workbench incorporates RF modeling, map handling, digital terrain, 3D display and analysis, a GUI, and real-time networking.

Supportability Analysis Workstation

Tools in use:

- Computerized Optimization Model for Predicting and Analyzing Support and Structures (COMPASS)
  - COMPASS is the US Army's standard system level of repair analysis (LORA) model. The objective of COMPASS is to simultaneously optimize both the maintenance concept and supply while achieving a given operational availability goal.
- Selected Essential Item Stockage to Availability Method (SESAME)
- Cost Analysis Strategy Assessment (CASA)
  - The CASA model is a LCC/TOC decision support tool. CASA can present the total cost of ownership depending on user selections: including RDT&E costs, production costs, and operating/support costs
- IMPRINT
- MERLIN-3D
- Pro/Desktop Express

System Development Workstation

Tools in use:

- CAD Tools: ProEngineer/CATIA/AutoCAD
- Visual Studio
- MATLAB
- Realtime Workshop
- EDA Tool TBD

DOTLMS Development Workstation

Tools in use:

- Automated Systems Approach to Training (ASAT)
- ATIA-M
- COMTEST
- SEAM-LSS
- OneSAF/JANUS/JCATS

Network Planning Workstation

Tools in use:

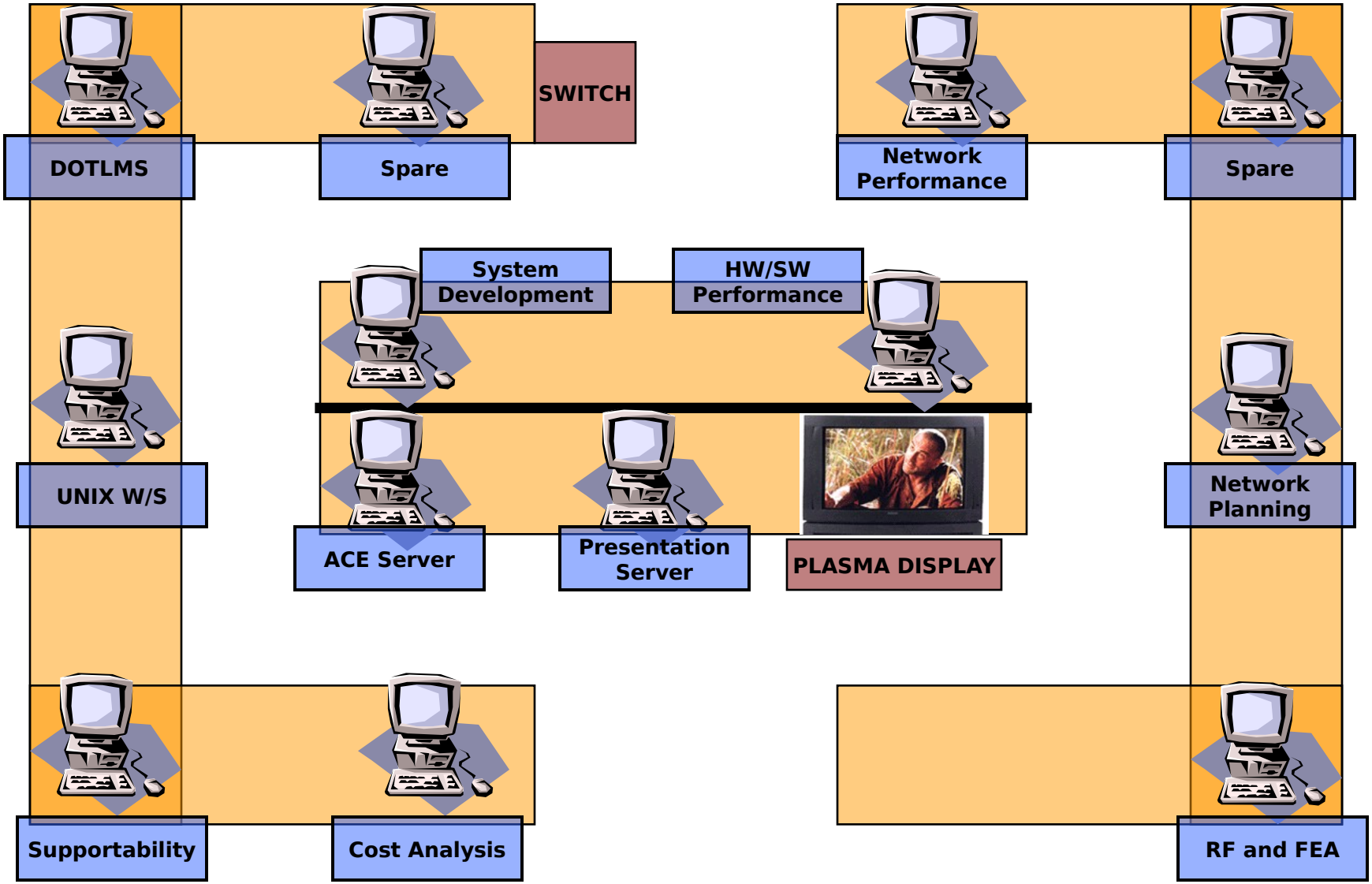
- Network Planning and Evaluation Tool (NPET)
  - NPET software enables the user to conduct operational planning and simulation and to assess legacy and future communication systems in warfighting scenarios.
- Operational Planning and Simulation (OPSIM)
  - The OPSIM tool enables users to simulate the logical and quantitative behavior of large-scale U.S. Army military networks at granularities down to device level.
- SPEED

ACE Server

Tools in use:

- IIS
- PTC Windchill
- EDS Team Center

SMART Lab Layout



Enable & Demonstrate Work-Flows